THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 39. Thursday, August 23, 1928. No. 627.

PUBLISHED WEEKLY

Subscription Terms: 15s. per annum.
Foreign and Colonial, 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telephone: Gerrard 3961 (4 lines).
Telegraphic Address: "Zacatecas, Rand, London."

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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

SEPTEMBER 4-7.
Institute of Metals:—Annual autumn meeting at Liverpool.

SEPTEMBER 5-12.
British Association for the Advancement of Science:—Meeting at Glasgow.

SEPTEMBER 22-27.
Iron and Steel Institute:—Autumn meeting at Bilbao.

SEPTEMBER 5-22.
Machine Tool and Engineering Exhibition at the Olympia, London.

Abstracting.

The question of abstracting presents a number of problems of no little importance. The average man working in any given line may suspect that he would find useful matter in the papers presented to meetings of technical, scientific, and professional societies in other lines of work, and the purpose of the abstract is to enable him to find out. It is in effect a précis or summary of the contents of a given paper, intended primarily to direct the reader to the paper itself if he himself feels that this would be desirable in view of the subject matter.

The first difficulty arises in connection with the qualifications of the abstractor. He must be something of an expert on the subject in hand if he is to be capable of doing the work adequately, bringing out its salient features and presenting a true impression of its significance, and men of the required calibre are sometimes apt to feel that the routine and somewhat dull work of abstracting is for them something of a waste of time.

There are several differences of opinion where abstracting is concerned, but it appears on the whole that the dissentients from the view expressed above form a small group of somewhat specialised requirements and outlook.

We are told, for instance, that no two workers can find their needs served by the same abstract, since one paper may be of value, say, to both the engineer and the chemist, and clearly the two would look for different things in the abstract which was to guide them.

It is also suggested sometimes that an abstract should be a critical assessment of the value of an original rather than a straight summary. One grave objection to this is that criticism of the subject matter of a paper can only have its full value if it be contributed to the discussion attendant on its original presentation. Embodied in a subsequent anonymous abstract it serves a far less useful purpose, whether to the author or to the general public.

In effect these two attitudes are part and parcel of the same thing. There are a number of highly-skilled workers who find it desirable actually if not in so many words to delegate a certain amount of their work owing to the difficulty of keeping in touch with all relevant developments. One way in which they do this is by securing abstracts that treat papers from their special point of view, and endeavour at the same time to assess its value. So far as they are concerned therefore the individual abstract remains a necessity.

But the real problem relates to the mass of general abstracts for general use. What is needed is an elimination of the repetition that occurs when the same paper is abstracted over and over again for different purposes, and by different organisations. So much of the energy at present dissipated in this way could be redirected into more useful channels, either by improving the general standard of abstracting or by providing abstracts where they have hitherto been lacking.

It is primarily a matter of co-ordination, which is itself dependent on mutual recognition and discussion of the problems by the parties concerned.

To summarise, therefore, a small minority of highly-specialised people require critical summaries or abstracts. The majority of people are content if they can read an abstract which is in the nature of a review, sufficient to enable them to know whether they should read the original or not. Different abstracts prepared by different agencies may be justified if they meet the demands of different groups, but beyond that any repetition or overlapping is undesirable and should be eliminated.

Maturity in Industry and Rationalisation.

Incessantly during the last decade the American and British Press developed a thought often attributed to Ford, that for industry to prosper all it had to do was to mass-produce sufficiently intensely so as to lower the cost of production so materially that the goods became purchaseable by a much larger number of people. For some silly reason, a section of the American Press has thought it wise to enunciate that any industry is comparable with human life, wherein two decades are to be associated with physical development and the balance of life constitutes a useful period called "maturity." Now having developed this idea, the next step is to assign certain industries to the status of maturity wherein physical expansion cannot be expected. In this category are to be placed the automobile and railway industries. We never appreciate such analogies, striking and interesting though they may be, as we consider they detract from clear thinking. We believe that in this country, at any rate, shibboleths whether old or new must be used as only being mildly illustrative. The new gospel is embodied in the word "rationalisation." Its application to any industry will determine whether expansion or contraction is profitable; it will seek to establish whether co-operation with another industry is desirable; it will enunciate the acquisition of wealth by an industry as a primary essential in order to maintain itself in a state of mechanical perfection. At the moment there is supposed to be a war between rail and road transport. A rational study to-day may show this to be an immediate essential, but perhaps a later peace conference may indicate that co-operation under the heading "transport industry" is the final solution.

The danger of the present time, which we believe to be passing, is substitution of smart slogans and catchy analogies for clear thinking. The tendency in business to-day is undoubtedly the national organisation of industries to compete with other industries as industries. As every industry, from agriculture to electrical engineering, draws on the foundry trade for essential supplies, there is a danger voiced by Mr. Ropsy in his manifesto to Belgian founders that we as founders may become the plaything of such nationally organised corporations, and—probably Mr. Ropsy is correct.

A Puzzle in Brass.

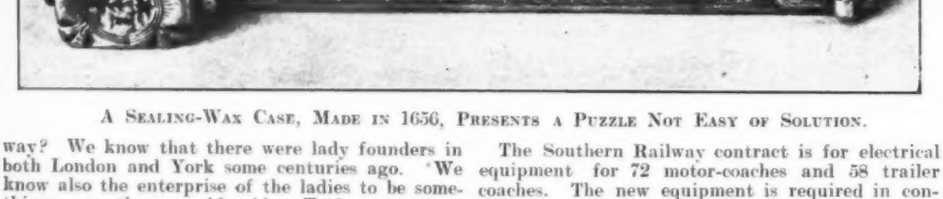
By H. Littlehales.

Sealing-wax cases of brass made nearly 300 years ago are far from common, and if we add to this the fact of a case in particular bearing an inscription which is both interesting and a very distinct puzzle we shall find such an example of a very special interest.

The inscription on the case shown in the appended picture is perfectly clear, and reads:—

"I was in Sheffield made & many can
Wittnes: I was not made by any man.
1656."

This inscription contains two peculiarities: (1) The ampersand (&) on metal, which is unusual, though it was common enough in writing for many centuries before; and (2) the strange statement that the case was not made by any man. Was it made by machinery or by a lady, or in what way? We know that there were lady founders in both London and York some centuries ago. We know also the enterprise of the ladies to be something more than considerable. To-day a rumour is current that they have even invaded the sacred precincts of the fitters' shop and the brass foundry. Possibly some reader may solve the puzzle before us?



A Sealing-Wax Case, Made in 1656, Presents a Puzzle Not Easy of Solution.

This interesting case is to be seen in the Victoria and Albert Museum. To the Director our thanks are due for the photograph given of it.

Foundry Trade Prospects in Derby.

Compared with a year ago there is not so much unemployment in Derby, and the prospects for the future are much brighter than for some time past. One or two useful contracts have recently been placed locally, but there has also been one which has been secured by another town. This would have been very much welcomed had it been placed locally, as it was one for no less a sum than £80,000. It was let for the carrying out the work of duplicating the pipe track from the Derwent Valley Waterworks, and was secured by Messrs. G. Shellabear and Sons, of Plymouth. Work has been commenced on the 47-inch steel main from Bamford filters to Ambergate.

But, while this big contract has been lost locally, a still larger one has been gained. The figure is £200,000, and the successful firm is the International Combustion, Limited, of Derby. The contract has been placed by the Metropolitan Power Station Company, at Neasden, which is to be remodelled. It is understood that a pulverised fuel system is to be substituted for the present twenty stoker-fire boilers.

Everything is proceeding as well as can be expected at the Staveley Iron Company's works, where, at present, the firm is engaged in the execution of a substantial order for pipes for a well-known industrial firm in the north. The pipes, which are of 78-inch diameter, are the largest ever made in the company's ordinary pipe pits. They are cast vertically in dry-sand moulds, the cones being struck off on a bar in the ordinary way.

The contract for 10,000 tons of cast-iron pipes for the Buenos Aires water undertaking, obtained by the Stanton Coal & Iron Company, should improve the working conditions in that part of the country, although the contract is by no means a record one either in weight or value.

More Foundry Contracts.

Three important contracts, totalling about £750,000 in value, have been placed with the Metropolitan-Vickers Electrical Company for electric railway equipment for the Metropolitan Railway, the Southern Railway, and the New South Wales Government Railways. In each case the contract is a repeat order following on large quantities of equipment already supplied.

The Metropolitan Railway contract is for 30 motor-coaches completely equipped and a number of equipments for trailer coaches. Each motor-coach equipment will include four 275-h.p. motors. The new stock will be of the compartment type, and will be used for local and express trains running between the City, Baker Street, Watford, and Rickmansworth. The Metropolitan-Vickers Company has placed the sub-contract for the coach-work, underframes, and bogies with the Birmingham Railway Carriage and Wagon Company.

The Southern Railway contract is for electrical equipment for 72 motor-coaches and 58 trailer coaches. The new equipment is required in connection with the conversion of part of the central section (late L.B.S.C.R.) of the suburban system from single-phase alternating current operation with overhead line to direct-current operation with third rail. The greater part of the conversion is now completed, the lines still remaining on the old system being from Victoria to Sutton and Coulsdon *via* Streatham Common and *via* Crystal Palace. The present contract is the fifth of considerable magnitude which has been placed with the Metropolitan-Vickers Company for train equipments for the Southern Railway. The last contract, placed in December, 1926, was for 232 motor-coach equipments and 210 trailer-coach equipments, totalling over £600,000 in value. It is of special interest to note that the maintenance costs of the equipment installed, much of which has been in service for periods up to 14 years, have been extremely low, probably the lowest of any railway in the world.

Sydney Contract.

For the Sydney Suburban Railways of New South Wales the Metropolitan-Vickers Company is to supply 100 motor-coach equipments and 100 trailer-coach equipments. The motors, two for each motor-coach, are units of 360 h.p., probably the most powerful individual motors ever installed for multiple unit trains. The electrification scheme is very extensive, involving ultimately more than 400 miles of track, and is bound up with the immense new bridge now being built across Sydney Harbour, for one of the most important railway extensions is a new section of line which will pass over the new bridge, forming a direct route from Sydney City to the north. The present contract is the fourth placed with the Metropolitan-Vickers Company for coach equipments and will bring the total of Metrovick-equipped coaches on this railway to more than 450 of each type.

The whole of the electrical equipment for the Metropolitan Railway and Southern Railway contracts, and the greater part of the equipment for the Sydney contract, will be manufactured at the Metropolitan-Vickers works at Trafford Park and Sheffield, ensuring work for a large number of employees for the next twelve months. The remainder of the equipment for the Sydney contract will be manufactured at the Metropolitan-Vickers works at Sydney.

Random Shots.

I noticed in the papers during the week news of several very large contracts recently placed by dominions and foreign firms with British manufacturers. The bare statement of fact that the order had been placed set me reflecting upon the very curious difference in attitude between the Press of this country and the Press of the United States to industrial news. In America the taking of a large order by a company is regarded as a justifiable opportunity for legitimate pleasure which the success inspires, like winning a match. It is an opportunity for Press comment, with a wealth of detail, often more picturesque than accurate, but undoubtedly entertaining to read, of the processes, products and officers of the plant concerned.

* * *

The attitude of the English daily Press is very impersonal. It gives the impression that gathering an order is, if anything, something to be ashamed about. At any rate, if it is not something to be ashamed about, publication of the fact in the Press definitely is!! The American works, on the other hand, will glory in taking a large order, and its Publicity Department will not hesitate to "tell the world."

* * *

As a matter of fact the bare bones of news items relating to industrial contracts, appearing in the English Press, except in rare instances, do not emanate from the works publicity department at all. They are collected in the main from enterprising weekly trade organs like that the name of which modesty forbids me to mention; and of course those who are engaged in a particular industry are notoriously sceptical about the lyrical outburst of the reports and journalists on the daily Press. Hence the bare bones are better unclothed. Some day, perhaps, the syndicated Press may wake up to the desirability of having an industrial expert attached to its staff, just as it keeps an expert to select tit-bits from the police-court news or the political news. Then, perhaps our industrial education will really begin.

* * *

As a matter of fact we have not yet recovered entirely from the days when trade was considered rather demeaning. We have yet to realise fully that it is productive industry which keeps everything else going, and which permits us to have such luxuries and necessities to civilisation as parliaments and prisons; cinemas, casinos and churches; workhouses and schools. Productive industry provides the motive power behind the wheels of progress, and by productive industry we mean, in the main, the basic industries of coal, iron, steel, engineering and shipbuilding.

* * *

With our basic industries in their present condition it might be suggested that the daily Press could, with advantage, recognise a little more freely the dignity, the importance and the romance of industry, and give it the space it deserves. There are far more stories in industry than there are in the law courts, or than in the mansions of Mayfair.

* * *

A New Alphabet for Ironfounders.

A is for Ale, a fluid that serves
To lubricate anything, even the nerves.

B stands for various words most expressive
That foundrymen use when the heat gets excessive.

C stands for Convention, held just once a year;
The roughest and harshest is then debonair.

D stands for the Dogs, without which you know
The life of us founders would seem mighty slow.

E, Exhibition, next year to descend
Upon us and teach us our ways to amend.

F is the Foreman, the kindliest soul,
On whom care for others takes very great toll.

Marksman.

Notes on Patternshop Management.—II.

By Ben Shaw.

Organisation of Different Kinds of Shops and the Checking of Patterns.

To obtain the maximum efficiency from a patternshop, consideration must be given to several factors including the class of work done. The efficiency of a shop depends in great measure on the foreman. Men of ability, combined with tact and firmness, are scarce, and, unfortunately, such men do not always reach the foreman's office. The position of foreman in a large shop employing, say, a hundred men, is very different from that in which a few men only are employed, albeit the small shop foreman may have the more onerous position; it depends upon the organising capacity of the man. In a small patternshop the foreman, especially if he be a working foreman, holds a really onerous position. He may have to estimate for work, he has in many cases to set down work, discuss construction with the men, maintain discipline, train the apprentices, check and pass work for the foundry, and possibly attend to the moulders. Unless in very small shops, it is not profitable to have a working foreman, because he is in too continuous and close contact with the men to maintain discipline, and he cannot possibly do justice to his own manual work. The most that should be expected from a man in such a position is to set down the larger jobs.

Whilst it may be admitted that organising ability is of great importance in the big shop, other qualities of equal importance are necessary in the small shop. We have known foremen patternmakers in small shops who have been called on to design a set of engines, although this is not common nowadays, but it is not at all unusual, even to-day, for a train of gears to be re-designed in the patternshop. In shops where only a few men are employed there is usually one man on whom the foreman can more or less depend. This man is in no wise a chargehand.

Labour Utilised.

In large patternshops there are four distinct classes of labour—journeymen-patternmakers, machinists, apprentices and labourers. Included in journeymen are foremen and chargehands. In well-organised shops, the duties of these various elements of labour are very clearly defined, and it is a mistake to suppose that the labourers are of little or no importance. Every experienced patternmaker will readily acknowledge the great assistance that is rendered to the shop by an intelligent labourer who is something more than a mere floor-sweeper. In small patternshops where there is not a proper pattern storekeeper, the labourer usually functions in that capacity, and can in many cases read an arrangement or detail drawing with fair skill, and not only get the main pattern, but also the necessary details, or mountings and covers in the case of valves. In large shops, of course, there may be one such useful labourer, while the others are quite unskilled.

It is a noteworthy fact that small shop foremen do not often get positions as foremen in large shops, which is not quite fair. If the class of work turned out is good, undoubtedly the small shop is a splendid training ground, especially as many of these men have been chargehands in large shops before securing these positions as foremen in small shops. In many cases the small shop foreman has no one with whom he can consult about work, and is therefore self-dependent.

In a large shop, the foreman is in great part an organiser. He has very little to do directly with the men. His duties may consist in estimating for work, but he has to prepare progress reports; he is in close touch with the drawing office, and he is, more than any of his assistants, the disciplinarian. In many shops the head foreman is not consulted about construction at all except when a modification of a design is thought to be advisable or a difference of opinion exists as to moulding methods. He has an assistant foreman, indeed, he may have two or three, and in all probability there are several chargehands. He may pass all drawings to the assistant foreman for distribution among the workmen after discussing constructional methods with him, or, what is more usual and a better practice, he may deal in many cases with the chargehands direct.

Checkers' Duties.

In patternshops where large work is made it is almost necessary to have chargehands in addition to assistant foremen, and the effect of this policy is a virtual dividing of the shop into different departments. Again, it may be possible for a shop with a hundred men to get along very well without recognised chargehands if the work is all small, whereas another shop with twenty men doing large work will require one or two chargehands. In some shops where chargehands are unnecessary, checkers are employed whose work comprises checking and passing patterns and coreboxes for the foundry. The responsibility for different classes of work is placed in different checkers. Sometimes, however, no method is adopted and the foreman apportions the work among the checkers quite independent of the engine number or the type of job. The checker concerns himself with the moulding of the pattern as well as merely comparing it with the drawing, although in a properly organised shop it should seldom be necessary for him to criticise the construction. Machining and contractions allowances must receive his special care.

There must be a very complete confidence between the foreman and chargeman if the best results are to be obtained from any patternshop. Where a chargehand system is in operation the men, except in special cases, do not set down their jobs, but receive the drawing board from the man in charge, sometimes not even seeing the blue-print. This is a rather short-sighted policy, because a great deal can be learnt from an examination of an arrangement drawing, and, furthermore, the man has not the same interest in his work if he does not know for what purpose it will be used.

"Leading" and "Charge" Hands.

Leading hand is the term applied in some shops to a chargehand, but the terms "charge" hand and "leading" hand do not mean precisely the same thing. A chargehand may have many large and small jobs going on simultaneously, but the leading hand takes charge of a big job, or at least one on which several men are employed, and completes it before he gets a new drawing. When a chargehand has two or more large patterns under way he invariably depends on one man on each job guiding and assisting the others. The chargehand upon giving out work either states how he wants it constructed or discusses it and modifies his views accordingly. Which is the better method depends on circumstances. Patternshops doing a standard class of work usually evolve what are considered by the foreman patternmaker and the foreman moulder the most suitable methods, and men have to fall into line. In shops doing general work, however, the position is vastly different, and there is scope for variation of methods. In marine shops, when, say, a turbine casing is started, a clever chargehand will so dovetail the work that it will not be necessary to draft men to other jobs until the casing is quite completed. This requires considerable skill. It is also possible by close and unobtrusive supervision to minimise the final inspection and checking by examining the various parts as they are made.

It will generally be conceded that efficiency in patternshops depends to a considerable extent on the wise distribution of work, because of the great variety of jobs and the big difference in skill of the men. But, apart from all consideration of individual skill, methods of planning work are usually adopted, and these ought to depend upon various factors, such as the size of the shop, whether it is a jobbing shop, and also whether the foreman has to work with the tools or whether he is purely a supervisor with several chargehands.

Inefficiency Caused by Sub-dividing.

Is the sub-division of a paternshop into several departments useful? It is doubtful. There are shops where the bedplate chargehand may have little to do, while the cylinder man may be running two or three large jobs. The mobility of patternshop labour is so important as to be almost a necessity. There is no reason why a man who must have a knowledge of the component parts of an engine should not be able to construct all large parts equally well. Thus even if the foreman prefers a certain chargehand for a specific type of pattern, he should vary the procedure occasionally. A practice that is frequently adopted in marine work is to give each chargehand a system to work through all the pipes and valves that comprise the system, particulars of which are supplied by the drawing office on drawings and sheets. One advantage of this is that if any modification of a casting is found necessary, dependent modifications on the same system are not overlooked. It is certainly more satisfactory than for the foreman to distribute work without method as the drawings come down from the drawing office.

Division of Duties.

In marine and electrical shops where twenty or more men may be employed on one large casing or bedplate the organisation varies in different establishments. In some of these shops the chargehands retain their squads for successive jobs, thus, as one pattern is being finished the men are transferred by the chargehand to a new pattern which he has set down. An important feature of this method is that the various squads in the shop become carefully balanced, each squad having two or three outstanding men capable of relieving the chargehand of some of the responsibility, because conducting the construction of a large pattern is more difficult than organising a small patternshop, and a simple error may entail the whole of the work having to be reconstructed. In other shops the custom is for the chargehand to send all his men to the foreman when he finishes a pattern, except one or two who remain permanently with him. There is generally a lot of foundry work necessary, and as the chargehand is not always able to leave the shop to level up a job in the foundry pit, or to explain a set of intricate cores, this work often devolves on the second man of the squad. This man may also assist the chargehand in setting out work, in order to get men started, and in every way he understudies the chargehand, and should at any time be able to take full control.

Specialist Craftsmen.

In most patternshops there are specialist craftsmen. There is, for instance, still a certain proportion of toothed wheels cast. Many, if not most, patternmakers could have made either worm, bevel or spur gearing, and some had a considerable knowledge of the theoretical principles involved, but such men are a rarity now; therefore, even in shops where few wheels are made the foreman values a man highly who can do this work. It is not usual, nor is it advisable, to distribute it through the shops, because, just as with the slide rule in the drawing office, if a man is not kept in practice he loses time in recollecting methods and does not work as confidently. There are at least two other classes of work which must be thus specialised—propeller work and loam work. Unless for very small propellers, it is not usual to make full patterns nowadays, or even patterns of a single blade. They are usually swept up in loam, cheaper and better results being obtained in this way. It is difficult to obtain a true screw from a delicate blade pattern which is rammed in sand, no mater how well seasoned is the timber of which it is made or how good is the workmanship, hence the chief reason for making propellers in loam.

Checking.

The examination or checking of patterns before they are sent to the foundry is one of the foreman patternmaker's most important duties. It

requires care and keen observation. A mistake while the work is on hand may be remedied without great loss, but it is too late after the job is cast. Checking is the supreme test of the foreman's ability. A mediocre man may get through his other duties if he has trustworthy and capable subordinates, but if he cannot examine intelligently he will fail. A man of this kind can organise and manage a large shop, where he has others to check work, better than a smaller shop where he has to rely upon himself. In a large shop where there are special checkers the foreman cannot be too careful in their selection. A man may be mediocre with tools but very efficient as a checker. The work of checking should not consist of merely comparing a blue-print or tracing with the finished pattern; a draughtsman could do that at least as well as a patternmaker. The work must be looked at from the moulder's point of view as well, with special regard to the particular foundry to which it is going, as the methods adopted by the foundry and the tackle at hand may alter the construction of the pattern. This point is of greater importance with large work than with small. A common pitfall of the patternmaker is the matter of too clearances in cores, which, if not taken into consideration, may make the machining of the work very costly.

It is in checking work that the draughtsman who has become a foreman patternmaker frequently fails. It is on the checking table that the patternmaker's worth is discovered. A beautiful furniture-like job may be inferior to a job more roughly made. It is better that patterns should be checked before rather than after they are painted. Bad workmanship is more easily detected when the work is bare, and it is easier and pleasanter to alter unpainted wood if alteration is necessary. A patched or faked job may look very well when it leaves the patternshop, but the atmospheric conditions of the foundry will discover its faults if it has any. Good castings cannot be made from bad patterns. If the foreman patternmaker is very busy, he will sometimes have patterns painted to avoid them warping and shrinking before they are checked; but if at all possible work should be passed as soon as it is finished. It is not fair to the craftsman not to do so.

A Bad System.

There are considerable advantages in a system which makes the man who gives out the work responsible for passing it when finished. The final checking should be supplemented by close watching while the work is being constructed. A tactful foreman or chargehand can see a great deal in a workshop whilst apparently seeing nothing. There is no less effective foreman than the one who sees everything, and lets it be known that he does so. In some patternshops the checking of sizes is effected by two chargemen, one reading sizes from the drawing while the other puts the rule on the work. It is a sub-dividing of responsibility which cannot be commended, besides being a waste of one man's time. There is a grave danger of overlooking little but important items in this way. After long practice two men may understand each other so well as to render mistakes improbable, but it is not often that two men so suited to each other come together.

Rational Procedure.

The efficient checker must be an intensely practical man. It may be necessary, or advisable, to reduce foundry costs, to modify slightly a pattern from the drawing, and it may be advisable to alter a size. Accuracy should be insisted upon, but if a pattern shows a slight discrepancy in some unimportant detail, it is ridiculous to have it altered. This applies more to very large work than to small or even medium-sized work. When dealing with large jobs, on which a dozen to twenty men may be employed, the drawing-board should be carefully measured before the work is commenced. There is a greater danger of a vital mistake being made when setting down a large pattern on the drawing-board than there is of one being made afterwards. It is generally advisable, when the work is finished, to examine the various distance or length rods first. It is sometimes necessary to check various parts of the work as they are made and before they are assembled. Where there are a large number of coreboxes they ought to be numbered, and corresponding numbers marked on the drawing-board. If this is done, the moulder will be saved endless trouble. The number of cores required should be clearly marked on the outside of the boxes, with particulars of any alterations necessary. In all cases when a pattern requires alterations at the foundry it ought to be marked "Two off thus, then two off altered."

Allowances for Moulding Conditions.

Some checkers compare the pattern and corebox with each view in turn. The better and more general way is first to check all lengths, then widths, then heights, and the pattern and corebox should not be checked together. There is less danger of a mistake being missed if the pattern is first concentrated upon, and the corebox dealt with afterwards. The corebox should always be shorter than the prints. The moulder invariably gains a little in thickness at the joints, so medium-sized patterns should always be made slightly shallower than the required size. It is good practice, except with large work, to measure the sizes for steel and brass work from the joint, with the iron contraction rule, and to measure ironwork with the standard rule. If this rule is proved by comparing the castings with the patterns, it will be found to be fairly accurate. There is not sufficient comparison of castings with patterns. It is only in this way that knowledge of the correct amount of contraction necessary for different classes of work can be had. Much depends on the thickness of the metal, apart altogether from the kind of metal used. The surface table is invaluable for small work. It is not possible to prove angles quickly and check centres with any degree of accuracy on an ordinary bench. Apart from the checker's surface table, in shops where small work with thin metal is made, a surface table ought to be part of the shop's equipment. The method of construction of the pattern ought to be considered first. A badly jointed pattern will not deliver readily from the sand. It is wise for the checker to dissemble the pattern first—that is, take off all the loose pieces and see that they are properly fitted, and also that the method adopted of keeping them in position, whether by dovetail, wire, or screws, is the best for the job. Taper in prints and ribs ought to be closely scrutinised. Many young hands do not value the importance of taper in the foundry. It does not take much more time to plane taper in the patternshop, and it saves a great deal of time in the foundry. Wood swells and warps in the damp sand, and when drawing the pattern, if ribs and prints have been left a parallel thickness, the mould may be seriously damaged. The more rapping a moulder has to get a pattern to deliver, the worse it is for both the pattern and the mould. The second consideration of the checker is machined faces and cores. It is sufficient to see that machining has been left where necessary, and that no machining has been left in inaccessible places, where area may be the greater consideration. The amount of machining may be observed when measuring.

Painting Patterns.

The painting in different colours of patterns for steel, brass, and iron work is only an advantage when storing the patterns as they are returned from the foundries; but it is a great advantage to the moulder if the metal is painted on the joints of patterns and coreboxes, with the prints painted a colour different from that of the pattern proper. Machined surfaces ought also to be clearly marked, or painted. It is well for a moulder to know where a good surface is essential.

Catalogue Received.

Safety First Equipment. — Messrs. H. G. Sommerfield, Limited, have sent us an advance copy of an eight-page catalogue illustrating, detailing, and pricing a well-chosen range of protective clothing and appliances, mainly made from asbestos. The range covered includes:—Gaiters, clogs, mitts, gauntlets, face shields, aprons, combination apron-leggings and spats, sand-blast helmets.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Nickel in Cast Iron.

To the Editor of The Foundry Trade Journal.

Sir,—We much appreciate the very kindly reference, in your issue of August 9, to our new loose-leaf binder containing the earlier publications of this department on nickel and its alloys.

We note, however, that you criticise the omission of a special section for "alloys with a cast-iron base," and ask whether we do not consider these of sufficient importance. We are very glad to have such criticisms and suggestions, but hope you will, on this occasion, allow us space to explain that the classification provisionally decided upon for the first edition of the binder is by no means intended to be exclusive, and it will be noted that we have arranged blanks so that our friends and correspondents may make a further classification, as they think fit. We are fully alive to the importance of nickel alloys with an iron base, and, as a matter of fact, an important programme of research work is already in hand which, together with other recorded data in our files, will in due course form the basis of a special pamphlet.—Yours, etc.,

For The Mond Nickel Company, Limited,
W. R. Barclay,
Research and Development Department.
Victoria Station House, Victoria Street,
London, S.W.1. August 15, 1928.

Book Review.

Brassfounders' Alloys. By John F. Buchanan. (Second edition.) Published by E. & F. N. Spon, Limited, 57, Haymarket, London, S.W.1. Price 10s. 6d. net.

This unique publication possesses much of real interest to our readers. No brassfounder, no matter how experienced, is really *au courant* with the thousands of alloys which are or have been placed on the market. It strikes the reader most forcibly that a drastic whittling down and standardisation is not merely desirable, but essential if even a section of the subject is to be kept within the bounds of technical decency. The author has drawn fairly freely upon matter which has appeared in the "Proceedings" of the Institute of British Foundrymen, and we think we recognise reproductions therefrom which have lost a little through double reproduction from the original photographs.

There is one phase which we hope to see amended in a future edition of the work, and that is the unification of physical test results. In this edition, roughly 50 per cent. of the tensile figures are returned as tons per square inch and the other half in pounds per square inch. Perhaps we may be faddish, but we definitely dislike the method of restarting the figure numbers at unity for each chapter.

We think that an adequate description of this book would be that it portrays adequately the present transitional stage through which the non-ferrous foundry is passing. It gives most the old-fashioned rule-of-thumb mixtures—tested by long experience—yet it indicates clearly (and deals with to a limited extent) that there is a definite scientific side to the industry. Thus it meets the current needs of the practical non-ferrous foundryman. The title, "Brassfounders' Alloys," chosen by the author, is too restrictive to be adequate, as white metals and aluminium are given important sections. The indexing is inadequate for a book of this character.

An American consortium is putting down a pipe line from the centre of the Rumanian oilfields to the Port of Constantza at an approximate cost of $3,000,000.

The Metropolitan-Vickers Electrical Company, Limited, have secured the contract for switchgear and steelwork for the Arapuni Hydro-Electric Works, New Zealand.

The Iron and Steel Industry in Czecho-Slovakia.

By Prof. Dr. Mont. Fr. Pishek.

Czecho-Slovakia comprises Bohemia—the most prosperous industrial and mineral-producing land of old Austria—Moravia, Silesia and Slovakia, with Subcarpathian Russia. The three first-named—Bohemia, Moravia and Silesia—formed in the past the Czech Kingdom, which, since the Battle of the White Hill, in 1620, had belonged to Austria; Slovakia and Subcarpathian Russia constituted formerly part of Hungary.

The Czecho-Slovak Republic has a total area of about 14 million hectares (about 54,000 sq. miles), but extends 600 miles east to west. Therefore its shape is unfavourable. Except on the southern boundary the frontiers of Czecho-Slovakia are formed by mountain barriers. On the north the country is bounded by Germany and Poland, on the west by Germany, on the south by Austria, Hungary and Rumania; the latter also constitutes its east boundary.

Czecho-Slovakia is inhabited by a number of nations. The Czechs and Slovaks—the same nation, differing only by their dialects—are the dominant groups. Out of nearly 14 million people the Czechs and Slovaks constitute 70 per cent. The remaining part consists of Germans, Ruthenians, Hungarians and Poles. The greatest part of this minority section consists of 3 million Germans, who mostly inhabit the frontier area bordering on Germany and Austria. Ruthenians, Hungarians and Poles form only a small fraction of the minority.

The geographical location of the country is favourable for commerce. It is situated between industrial West Europe and agricultural East Europe and midway between the Baltic and the Adriatic Seas.

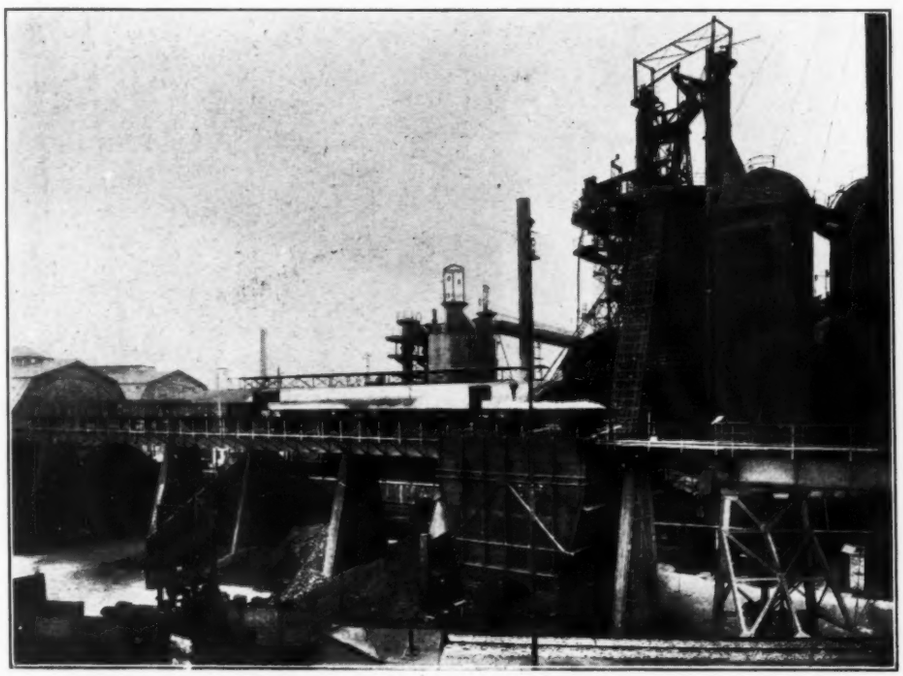


Fig. 1.—Blast-Furnace Plant at Witkowitz.

Raw Materials for the Iron Industry.

As regards iron and coal, Czecho-Slovakia is the most richly endowed among all the small European countries. There are three large coalfields of importance in the country: (1) The Moravská-Ostrava-Karvinâ fields in North Moravia and Silesia; (2) the Kladno fields in the centre of Bohemia, near Prague; (3) the West Bohemia fields, in the neighbourhood of Pilsen. Besides these, there are numerous less important coalfields scattered throughout the different provinces.

The deposits of Moravská-Ostrava give coking coal of very good quality, while those of Kladno give a good coal, but not suitable for coking. The West Bohemian deposits give also good but not coking coal; the other beds furnish brown coal or lignite. There is an abundance of lignite, important deposits of which are found in the region of Most and Duchcov, in North-West Bohemia, where it is exploited by surface work.

The production of coal in Czecho-Slovakia exceeds the requirements of the country considerably; therefore coal constitutes one of the chief export articles. In 1926 the country's production was: Coal, 14,180,000 metric tons; lignite, 18,516,000 tons; total, 32,696,000 tons. The production of coke in the same year amounted to 1,957,000 tons.

Iron-ore deposits of various qualities are widely distributed in Czecho-Slovakia, but generally they are of moderate grade. The principal iron-ore region is that of Nuczice, in Central Bohemia, near Prague, furnishing the principal Czech iron-ore, "chamoisit," *i.e.*, a silicate of iron and aluminium, an oölitic ore, containing about 35 per cent. of iron with a high phosphorus content. Small quantities of hematite and limonite are found in Bohemia, in the Brdy Mountains, between Prague and Pilsen. In Slovakia some iron ores are mined to a small extent—especially siderite with varying contents of manganese. In 1926 about 1,400,000 tons of iron ore were mined in Czecho-Slovakia.

The native iron ores with their moderate contents of iron are insufficient for the considerable Czech iron industry. Therefore the richer foreign

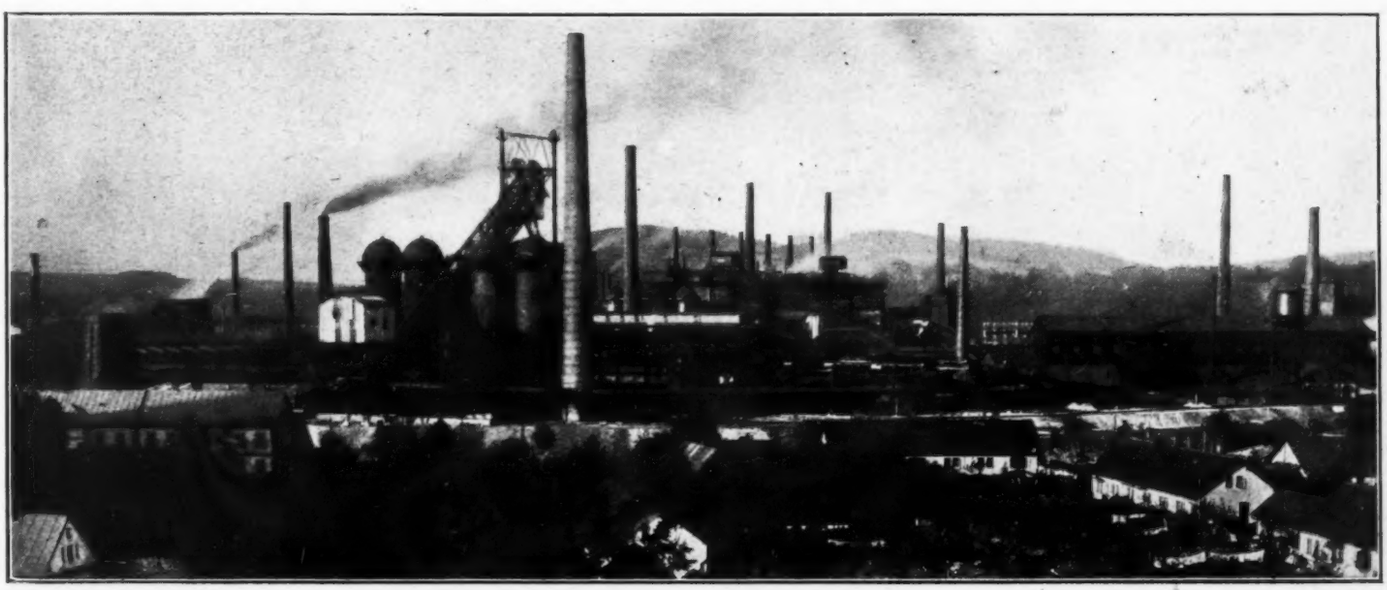


Fig. 2.—View of Ironworks at Trzhinec.

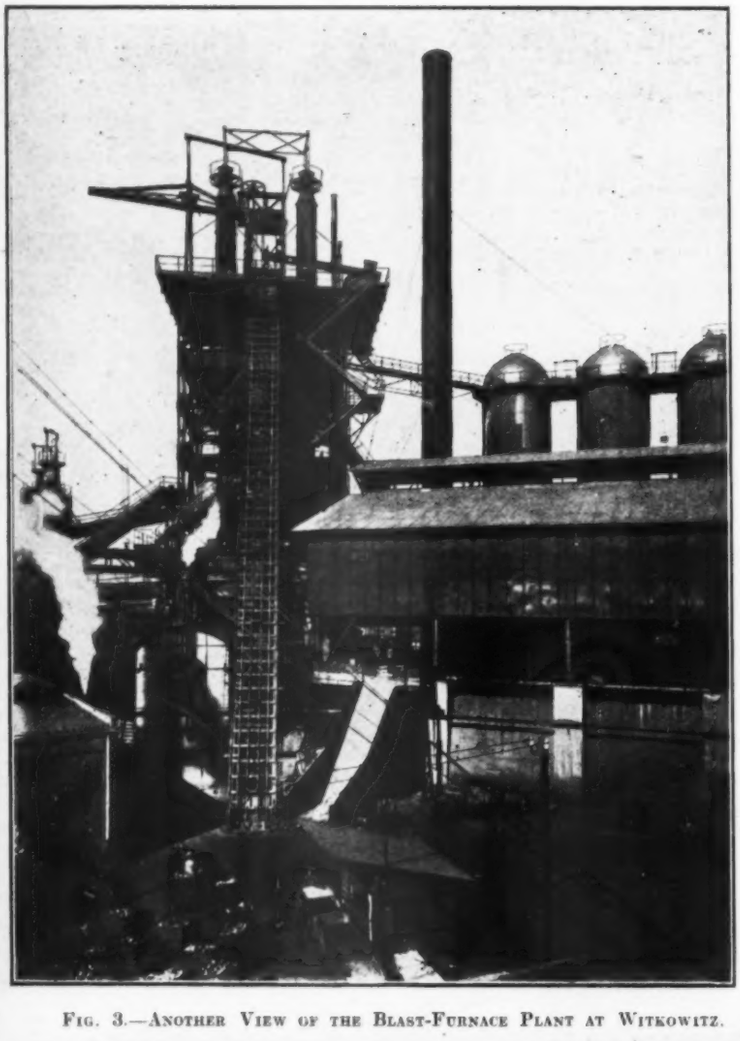


Fig. 3.—Another View of the Blast-Furnace Plant at Witkowitz.

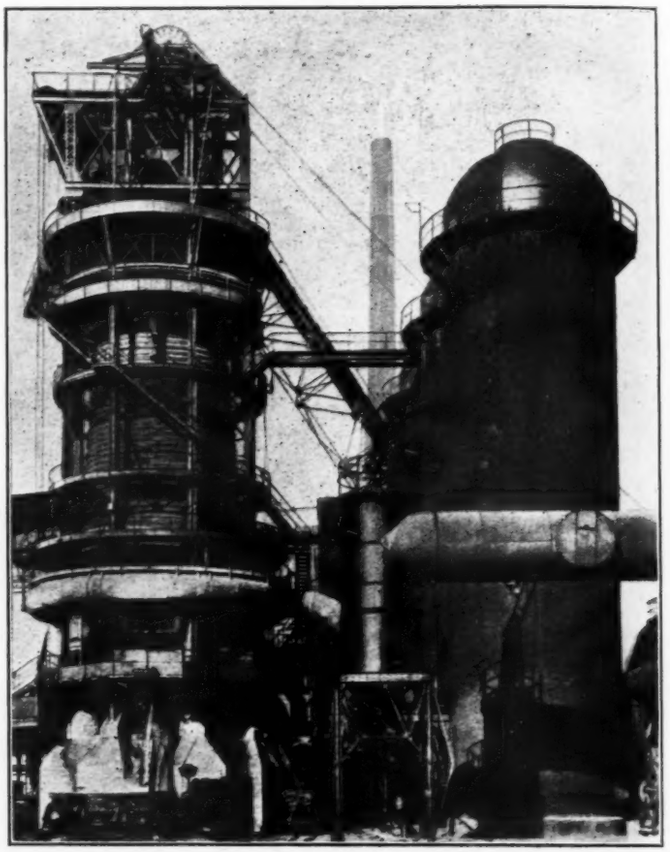


Fig. 4.—A Large Blast Furnace at Königshof.

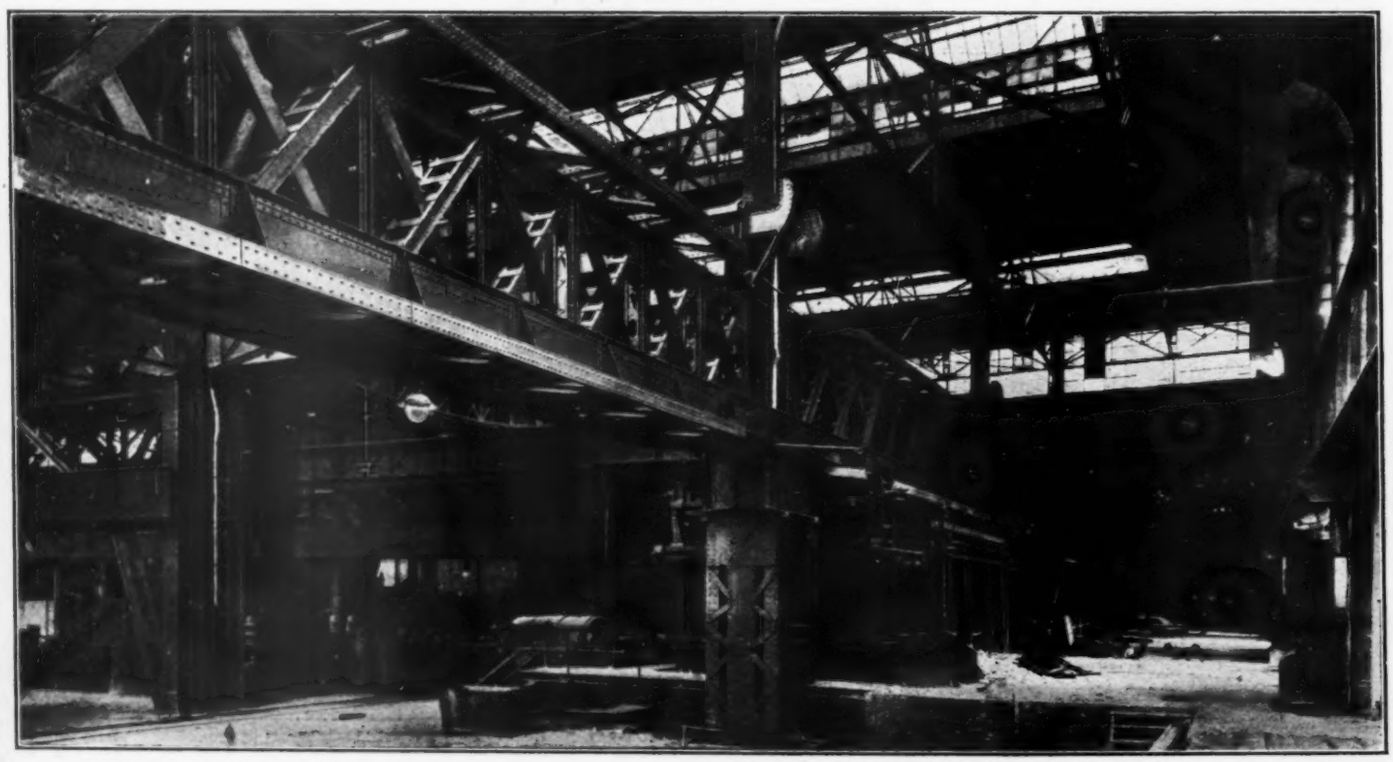


Fig. 5.—Open-hearth Furnaces at Skoda Works, Pilsen.

ores are imported and mixed with them. These imports comprise especially the rich ores from Sweden, imported by way of the Oder, including a proportion mined in Sweden at their own mines by the leading Czecho-Slovak ironworks at Witkowitz; and the ores of Austria (Erzberg) and Yugoslavia (Prior).

Fig. 6.—Tapping Side of Open-hearth Furnace at Skoda Works, Pilsen.

Czecho-Slovakia is very rich in refractory material, the kaolin deposits in south-west Bohemia, and the magnesite deposits in Slovakia, being well known. World known is the superior quality of the Czecho-Slovak Dinas bricks. The largest manufacturers of refractories are the Západoczeské kaolinové závody (West Bohemia Kaolin Works), near Pilsen, Bohemia.

Ironworks in Czecho-Slovakia.

For many years, during the first half of the last century, there were, in the forest regions of Czecho-Slovakia, many small blast furnaces producing charcoal pig-iron; these ironworks were situated near to the ore deposits from which small quantities of ore were obtained in many different places. These iron-works existed mostly in Bohemia, in the district south-west of Prague between Prague and Pilsen in the river basin of the Berounka; in Moravia in the neighbourhood of Brno; north of Moravia in the environs of Frenshtát, and in Slovakia in the Carpathians. In the early days these blast furnaces produced limited quantities of pig-iron, owing to the lack of transport facilities; but later, the invention of the steam-engine, and the expansion of the machinery industry generally, together with the development of means of transport, effected a great revolution in the iron industry of the country.

The only Czecho-Slovak coking coal is found, as already noted, in the region of Moravská-Ostrava, North Moravia. The largest ore deposit is in the neighbourhood of Nuczice, in the centre of Bohemia, 400 km. (250 miles) away. Between these two regions there is no waterway which might permit a cheap transport; they are connected by railway only.

These two regions—the region of Nuczice and that of Moravská-Ostrava—are the principal centres of the iron industry in Czecho-Slovakia, notwithstanding that their location renders transport conditions far from favourable. Ostrava's coke must be taken to the Nuczice ore by railway, and conversely, the Nuczice ore has to be conveyed to the Ostrava coke. Limestone is found in both regions.

The Czecho-Slovak iron and steel industry of to-day is concentrated in these two regions. There are indeed some small charcoal blast furnaces in Slovakia, at Rozhnava, Ztracená, and elsewhere, but they are without importance and are nearly all idle.

The last of the charcoal blast furnaces in the historical crown lands was that of Komárov in Central Bohemia, south-west of Prague, pulled down in 1921. The output of this blast furnace was about five metric tons of grey pig-iron per day.

The leading blast-furnace works are those of Witkowitz and of Trzhinec, in the region of Moravská-Ostrava, and the works of Königshof and Kladno in the region of Nuczice.

The works of Witkowitz, owned by the Witkowitz Mining and Smelting Company, have seven blast furnaces producing forge and foundry pig-iron and are the greatest pig-iron smelters of Czecho-Slovakia. Figs. 1 and 3 give views of

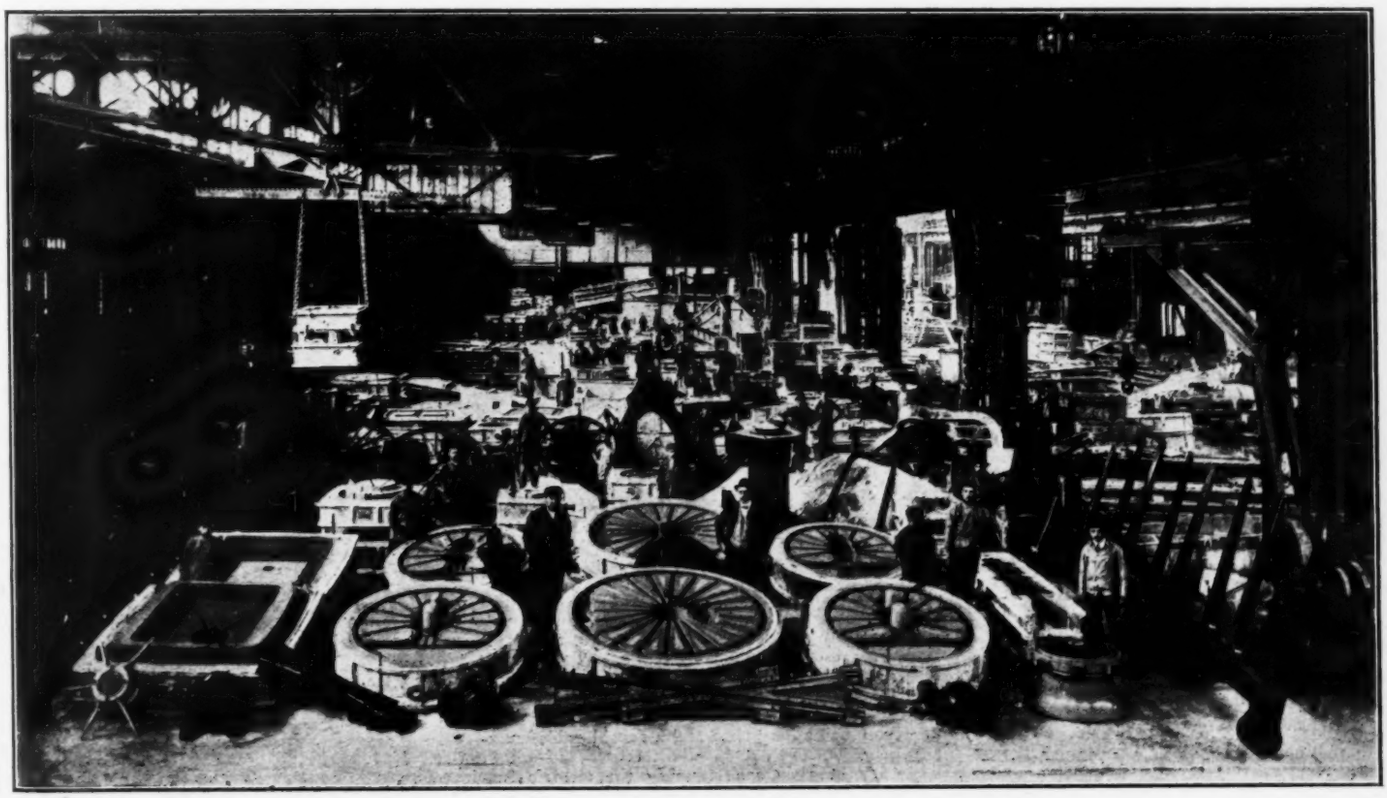


Fig. 7.—The Steel Foundry at Witkowitz.

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some of the blast furnaces at these works. The output of the largest furnace is about 600 tons of forge pig-iron per twenty-four hours.

The other large iron-works of this region are those of Trzhinec, owned by the Mining and Smelting Company, with four modern blast furnaces (Fig. 2), each having a capacity of 240 tons of grey pig-iron per day.

These two works consume a considerable amount of Swedish iron ores, and produce foundry iron with a medium content of phosphorus (on an average 0.8 per cent.), and 0.7 to 0.8 per cent. of manganese, and hematite iron with 0.15 to 0.20 per cent. of phosphorus. The output of pig-iron in both these works in 1925 was 720,000 tons.

The ironworks in the region of Nuczice consist of those in Kladno and in Königshof, each with four blast furnaces; but only Königshof produces foundry pig-iron, with a high content of phosphorus, up to 1.3 per cent. Both these works, which are the property of the Prague Iron Company, operate largely upon their own iron ores of Nuczice, but are obliged to use the coke of the Moravská-Ostrava region, the result being that the cost of production is high. The impossibility of converting the Kladno coal into coke is a great disadvantage for these works. The largest of the blast furnaces of this region, Königshof, is illustrated in Fig. 4.

Steelworks.

The largest steelworks of Czecho-Slovakia are those of Skoda and Witkowitz, though the steelworks of Czeskomoravská-Kolben-Danek in Prague, Ignaz Storek in Brno, and the Steel and Ironworks in Olomuc are also important.

The steelworks of the Skoda Works are the largest in the country, consisting of two plants: One of these has nine open-hearth furnaces of a total capacity of 286 tons, one 10-ton Fiat electric furnace and some Héroult electric furnaces. The lining of eight open-hearth furnaces is basic; only one furnace has an acid lining. Figs. 5 and 6 show views of the open-hearth furnaces, which are served by three charging machines. The furnaces are heated by producer gas. The seven moulding bays have a surface of about 86,000 sq. ft., and in these, castings up to 80 tons in weight can be made.

The steel plant at Witkowitz consists of 3 open-hearth furnaces of 35 to 40 tons, one of 15 tons, and 3 Héroult electric furnaces of 6, 2 and 1 ton respectively. The lining of the open-hearth furnaces is basic. Fig. 7 shows a view in a bay of the foundry served by this plant. The surface of the moulding bays amounts to 92,000 sq. ft., and the annual output to 11,000 metric tons. The open-hearth furnaces are heated by gas, produced in producers of different types, and in one case by a mixture of coke-oven and producer gas.

Iron and Steel Output in July.

The National Federation of Iron and Steel Manufacturers report that the number of furnaces in blast at the end of July was 131, a net decrease of 10 since the beginning of the month. Production of pig-iron amounted to 537,800 tons in July, compared with 563,700 tons in June, and 645,800 tons in July, 1927. The production included 168,100 tons of hematite, 201,600 tons of basic, 130,800 tons of foundry, and 23,200 tons of forge iron. The output of steel ingots and castings in July amounted to 666,900 tons, compared with 709,500 tons in June, and 687,100 tons in July, 1927.

Reports and Dividends.

Swan, Hunter & Wigham Richardson, Limited.—Interim dividends of 3 per cent., less tax, on the preference and ordinary shares.

Henry Briggs, Son & Company, Limited.—Profit, £45,393; brought forward, £51,993; dividend of 5 per cent., less tax; carried forward, £48,205.

Edward Wood & Company, Limited.—Net profit, £20,139; preference dividend, 5 per cent.; ordinary dividend, 6 per cent., both less tax; carried forward, £17,292.

Notes on a New Furnace for Steel Works Intending to Produce Small Castings.*

By M. G. Lely.

M. Lely remarked that the enormous development in the production of motor vehicles, agricultural machinery and tractors and in the electrical and chemical industries had led to a great increase in the use of cast iron and steel. Apart from the cast iron and steel used in the production of ordinary machine castings, special qualities of these metals had had to be produced according to their particular purpose, and works had been obliged to specialise. The chief varieties of these special qualities might be summarised as follows:—(1) Cast iron for metallurgical furnaces; (2) acid-resisting cast iron; (3) nickel iron; (4) black heart and Réaumur malleable iron; (5) mild steel; (6) nickel steel, nickel-chrome steel, etc.; and (7) manganese steel.

These irons and steels were produced either in the cupola, the converter, the open-hearth furnace or the electric furnace. None of these methods of melting, however, was sufficiently adaptable to replace one another, so that foundries were obliged to specialise and consequently restrict their field of action. Obtaining the necessary supplies also involved considerable delay owing to the distance of the works which produced them. If the state of the market and the processes employed were carefully studied, it would not be difficult to conceive of one foundry in each district which could be provided with orders for these various irons and steels in sufficient quantity to ensure a large output. But it would be still better if a small furnace could be obtained which could turn out some of these special metals economically. The problem to be solved, therefore, was to get a furnace capable of producing the majority of these metals with an adaptability similar to that of the cupola. It was, of course, only small castings that were in question.

Hitherto small castings in which greater strength was required than that of cast iron had been made from cast steel produced either in the crucible, the converter, the open-hearth furnace or the electric furnace. These methods of manufacture were not entirely satisfactory in the case of small castings for the following reasons:—With regard to malleable cast iron, the drawback was that once the castings were poured and annealed it was impossible to rectify them cold, so that any deformation of importance in these castings necessitated their rejection. Moreover, although manufacturing methods had been improved in recent years, it was nevertheless the case that this delicate system of manufacture was still uncertain in its results.

Small castings made with crucible steel were perfectly satisfactory, but the use of crucibles was very troublesome. If the output was to be large, moreover, gas furnaces had to be used, and these were very costly to construct, while if they were to be used economically their working had to be continuous.

The use of the small converter exclusively for the production of small steel castings was hardly practical, as the minimum capacity limit for that type of converter was about 2 tons, which was much too large a quantity if only small castings were required, as the metal at the end of pouring was not sufficiently fluid for this type of work. The same drawbacks existed in pouring small castings with open-hearth steel as in the case of the small converter.

There remained the electric furnace, which could give complete satisfaction; but its use was restricted by the cost of current, so that this type of furnace could be installed only in the vicinity of hydro-electric stations supplying current cheaply. Even then the cost price of electric steel was very high, as getting up the temperature took a long time and a considerable quantity was required, while owing to the long interval necessary between each tapping the electric furnace was not an apparatus which readily lent itself to rapid production.

All the foregoing reasons had led M. Lely to construct a furnace which was capable of overcoming these disadvantages, and which was a most adaptable apparatus compared with the cupola, as it could produce different qualities of metal in consecutive pourings. The most difficult problem was the production of small castings, as small as those in malleable cast iron, but in steel. This difficulty was overcome by casting a low carbon steel, which acquired great malleability on being suitably annealed. This problem having been solved, all the other properties were, of course, easily obtained.

The furnace consisted essentially of a rotary cylinder. Its characteristics were that the flame could either lap the metal or blow over it to bring it to a high temperature, and the blast was heated by the recuperation of the furnace gases. An ingenious arrangement of the burner enabled a neutral flame of very high temperature to be obtained; this enabled the bath to be stirred without overheating the furnace lining, which had hitherto been the cause of many disappointments. The furnace was supplemented by a manufacturing process for the re-utilisation of steel scrap.

When samples were being taken the furnace remained in full operation until the last ladleful had been removed. The metal, therefore, remained fluid, which was otherwise hardly possible except in the electric furnace. Hitherto the processes for re-utilising steel scrap had been carried out with the cupola, the electric furnace or the open-hearth furnace. Their basis was the treatment of the bath either by the addition of carbon or by the decarburisation of the metal treated. In the process suggested by M. Lely the liquid steel was obtained by melting scrap in a patent revolving furnace with an addition (manganese) other than carbon. As the steel was melted with "medicine," which was more absorbent of oxygen than carbon, the re-utilisation of the steel scrap by melting was considerably simplified. The properties of the steel obtained depended on the scrap used, but they could compare with those of crucible steel.

In conclusion, M. Lely said that the metallurgical industry was now in possession of a furnace which enabled all kinds of small castings to be produced in mild steel or alloy steels. There was no doubt that the general adoption of the process would enable malleable castings to be replaced by a metal really superior in quality.

* A Paper presented to the Spanish Foundry Congress.

Derby Industrial Alliance.

The members of the Derby Area Committee of the National Industrial Alliance who were entertained by Mr. and Mrs. W. Price Abell, of Castle Hill, Duffield, had a very enjoyable time, there being many prominent members of the foundry trade present.

Proposing a vote of thanks to Mr. and Mrs. Price Abell, the Mayor of Derby said the members of the Committee met together in the winter months and debated problems common to people of both sides of industry, the employer and the employee. Their object was to obtain constructive ideas of mutual help to everyone. The problems they had to confront were two-sided, and the best way to get to the bottom of them was to view them from both sides. The Committee was doing excellent work in Derby.

In responding, Mr. Abell said that in industry both sides had to give and take. Comparing the United States with England, he said that U.S. had £143,000,000 worth of goods less than they required, but in England they had £391,000,000 worth of goods more than they could use.

Large Electric Telpher at the Leipzig Fair.—One of the conspicuous exhibits at this year's Trade Fair, Leipzig, was a giant electric telpher in actual operation. It formed one of many outdoor exhibits of machinery. The track took roughly the form of a long ellipse, to illustrate the transporting of goods on straight lines and around curves.

Graphite in Grey Cast Iron and its Influence Upon the Mechanical Properties.

The formation of the graphite and its influence upon the mechanical properties of grey cast iron have been investigated by many authors, and several methods have been worked out in order to obtain a high duty cast iron. P. Bardenheuer and K. L. Zeyen,* after having carefully studied all the experiments hitherto made, came to the conclusion that some questions arising from this problem are not yet fully answered. They, therefore, carried on the following experiments.

Solubility of Graphite.

In order to determine the solubility of graphite in molten iron, samples weighing about 2.5 oz., the composition of which is given in Table I, were melted in a resistance furnace of the Tammann type and heated to different temperatures (from 1,200 to 1,700 deg. C.). After having been kept

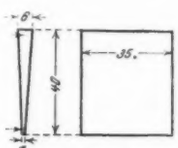


Fig. 1

at that temperature for fifteen minutes they were cooled in the furnace to 1,250 deg. C. and poured (at about 1,200 deg. C.) into a cold copper chill mould. The dimensions of the samples are given in Fig. 1. The top and the base of the wedges

Table I.

Sample No.	T.C.	C.C.	Gr.	Si.	Mn.	P.	S.
	%	%	%	%	%	%	%
1*	2.95	1.29	1.66	1.74	0.08	0.025	0.013
2†	3.45	1.41	2.04	1.59	0.04	0.034	0.012
3†	3.69	0.68	3.01	1.63	0.68	0.600	0.061

* Made from Swedish pig-iron.
† Cupola iron.

were examined under the microscope. The results of the micrographs given by the authors are summarised in Table II. From these figures it is to be seen that the solubility of the graphite depends from the temperature and the total car-

Table II.—*Graphite no longer visible at a magnification of 50 × of the wedge.*

Sample No.	In the top at deg. C.	In the base at deg. C.
1	1,200	1,500
2	1,300	1,600
3	1,700	1,700

bon content of the melt. At lower temperatures, when the solution is not yet completed, graphite nests are formed, the number and the size of which increase with the increasing total carbon content at the same temperature. There is some evidence that the phosphorus and the sulphur also influence the solubility of the graphite. A change in the amount of graphite at a definite temperature which was observed by Piwowarsky could not be confirmed.

Influence of Superheating.

The next experiments were designed to show the influence of the superheating temperature upon the amount and the size of the graphite when the samples were cooled slowly. One series of experiments was carried on *in vacuo*, another in the air. The compositions of the irons used are recorded in Table III. The samples weighing about 2.5 oz. were slowly heated to different temperatures (from 1,200 to 1,800 deg. C.), kept at temperature for fifteen minutes, and slowly cooled in the furnace. The melts made *in vacuo* when having reached the temperature of 500 deg. C. were cooled in the air. The total carbon and the graphite contents of the samples heated *in vacuo* are given in Fig. 2; that of the melts heated in the air in Fig. 3. The microscopic examination revealed the following facts. The number of the coarse graphite flakes decreased with

Table III.

Sample No.	T.C.	C.C.	Gr.	Si.	Mn.	P.	S.
	%	%	%	%	%	%	%
4	2.99	0.71	2.28	1.75	0.91	0.069	0.024
5	3.38	0.81	2.57	1.69	0.67	0.440	0.078
6	3.47	—	3.47	3.32	0.55	0.050	0.023

the increasing superheating temperature. This tendency is more pronounced and begins at lower temperatures with the vacuum melts than with the samples made in air. Sample No. 6, for instance, shows the eutectic graphite formation at 1,200 deg. C. when melted *in vacuo*, at about 1,500 deg. C. when melted in the air. With the increasing superheating temperature the amount

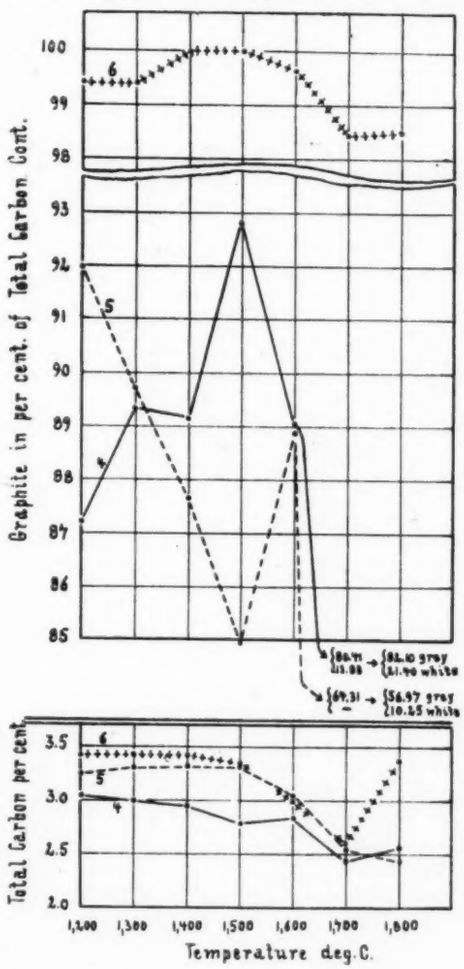


Fig. 2.

of ledeburite increases in the vacuum melts; with the samples Nos. 4 and 5 ledeburite is seen in the structure at 1,700 and 1,800 deg. C.; with sample No. 6 at 1,800 deg. C. In the case of the samples heated in the air the tendency of freezing according to the cementite system begins at lower temperatures, but occurs without any regularity; ledeburite shows also with sample No. 4 at 1,500, 1,700 and 1,800 deg. C., but not at 1,600; with sample No. 5 at 1,700, but not at 1,800 deg. C.; with No. 6 only at 1,600 deg. C. All the samples with white fractures showed an external zone of grey iron. This is due to the fact that the material from which the crucibles are made favours the graphitisation partly in a direct manner, inasmuch as it forms nuclei for the graphitisation, partly through a reduction of its silica content. The increase of the silicon content of some vacuum melts is given in Table IV.

Table IV.

Sample No.	Superheating Temp. deg. C.	Silicon per cent.		
		Grey zone.	White interior.	Original content.
4	1,700	1.94	1.91	1.75
4	1,800	1.83	1.82	1.75
5	1,800	1.92	1.96	1.69

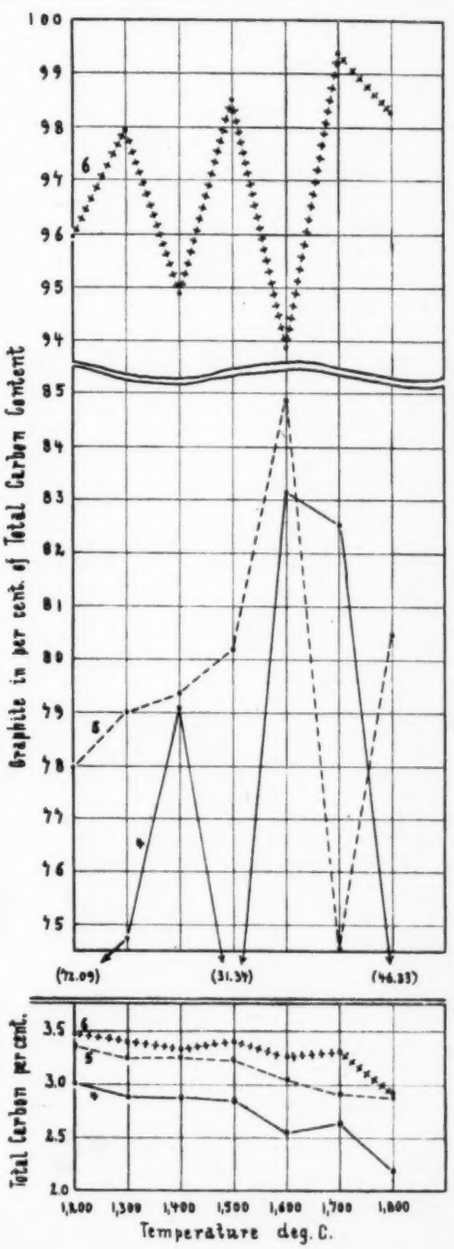


Fig. 3.

The fact that some investigators found an increase of the graphite content at temperatures above 1,500 deg. C. can also be explained by

*Die Giesserei, 1928, No. 16, pp. 354/65; No. 17, pp. 365/93; No. 18, pp. 411/20.

the interaction of the crucible material with the melt. This action is favoured by high temperatures, the grey external zone thereby being increased. With the irons melted in air other factors may also influence the graphitisation; for instance, the gas content of the melt.

Graphite the Controlling Factor.

After a careful examination of the literature concerning high-duty cast iron the authors came to the conclusion that though the matrix may influence the mechanical properties of cast iron to some extent, it is the amount and the distribution of the graphite which control the quality for the most part. Experiments were carried on to examine the influence of the total carbon content upon the size of the graphite and the strength of sand-cast and chill-cast bars. The compositions of the irons used are recorded in Table V, the total carbon contents ranging from 1.85 to 3.47 per cent.

Table V.

Sample No.	Si.	Mn.	P.	S.	Raw material.
	Per cent.	Per cent.	Per cent.	Per cent.	
10	1.7 to 1.9	0.6 to 0.8	0.3 to 0.5	0.06 to 0.1	Cylinder iron scrap.
11	1.6 to 1.9	0.8 to 1.0	0.02 to 0.07	0.016 to 0.024	Swedish charcoal pig.
12	3.2 to 3.5	0.55 to 0.71	0.02 to 0.07	0.023 to 0.027	Swedish charcoal pig.
13	As Iron No. 11				50 per cent. of Swedish pig + 50 per cent. of No. 11 scrap.

In addition to the raw materials recorded in the table there were also used pure soft steel scrap, ferro-silicon containing 83 per cent. of silicon, ferro-manganese containing 77 per cent. of manganese, ferro-phosphorus, and ferro-sulphur. The melts weighing about 65 lbs. were made in an acid lined furnace with a slag consisting of 85 per cent. of silica sand and 15 per cent. of lime. They were heated to 1,400 deg. C. and poured at 1,350 deg. C. From each heat there were poured two bars into dry sand moulds and two bars into iron chill-moulds with a wall thickness of 1.0 in. The bars had a diameter of 1.18 in. and a length of 27.6 in. The chilled bars packed in cast-iron turnings were annealed at from 850 to 950 deg. C. for six hours and very slowly cooled in the furnace. They were examined for tensile strength, transverse strength, impact strength (test bars without notch), and Brinell hardness.

The experimental data for sample No. 10 are given in Fig. 4. It is to be seen that for both the series there exists a maximum value at about 2.6 to 2.7 per cent. of carbon. The values of the chilled bars, however, are by far higher than that of the sand-cast bars. The microscopic inspection of the sand bars showed that the amount and the size of the graphite were diminished with the decreasing carbon content. With the chilled bars a refining of the graphite could not be detected. The matrix of the sand bars was entirely pearlitic, that of the chilled bars consisted of ferrite with some pearlite. The fact that the chilled bars, in spite of their ferritic matrix, showed higher values than the sand bars with a pearlitic matrix, confirms the opinion that the amount and the size of the graphite are of primary importance for the mechanical properties.

The experimental results with sample No. 11 are given in Fig. 5. With the sand bars there exists a maximum value for the tensile strength, the transverse strength, and the impact strength at about 2.7 per cent. of carbon. With the chilled bars the highest values are obtained with the lowest carbon content. The structure of the sand bars consisted of pearlite with coarse graphite flakes which did not show a fine eutectic formation except at very low carbon contents. In the chilled bars the graphite formed nodules like the temper carbon, the amount and the size of which decreased with the decreasing carbon content. The matrix of the chilled bars was entirely ferritic with the highest carbon content and pearlitic with the lowest carbon content. The experiments show that the high strength of the pearlite cannot become effective except when the graphite is in a finely divided state.

The experimental data for sample No. 12 are shown in Fig. 6. The chilled bars containing from 1.85 to 2.31 per cent. of carbon showed blow holes; therefore the tensile strength is lower than that of the sand bars. The structure of the latter was entirely ferritic with the highest carbon content, the other bars showed a pearlitic texture. The amount and the size of the graphite flakes decreased with the decrasing carbon content. The structure of the chilled bars was entirely ferritic, the graphite being in the eutectic formation or forming small nodules.

With one exception the strength figures of the sand bars of sample No. 13 were below that of sample No. 11. The cause is that the raw material, 50 per cent. of which consisted of sample No. 11 scrap, contained graphite, whereas that of sample No. 11 was white pig iron. From this it may be concluded that it is better to alloy white iron in the molten state than to use graphitic iron without superheating it. The test figures of the chilled bars corresponded to that of sample No. 11.

Further experiments showed that an annealing temperature of from 750 to 850 deg. C., which is somewhat above the pearlite point is not sufficient to decompose all the carbide when the annealing period is six hours.

Treating the Molten Iron.

(*a*) *Superheating the Iron.*—By superheating the iron bath many investigators succeeded in getting high duty cast iron starting from raw materials of inferior quality. Ropsy,* on the other hand, showed that by superheating a mixture of hematite and Swedish pig-iron the mechanical properties were diminished. In the present experiments heats weighing about 135 lbs. were prepared in a high-frequency induction furnace. Only scrap was used as raw material. A thick layer of slag had to prevent the burning of the carbon and the other components. From each heat immediately after having reached a definite temperature (up to 1,600 deg. C.) part of the metal was tapped and two bars were cast in sand moulds at about 1,350 deg. C. In Table VI there are recorded the highest test values and the lowest ones together, with the corresponding superheating temperatures, total carbon and graphite contents. Though a refining of the graphite increasing with the increasing superheating temperature could be established, the influence of the temperature upon the mechanical properties is not uniform. The authors suggest that the effect of high temperatures cannot be seen clearly but after a certain period of reaction. The increase of the mechanical properties in the present experiments seems to be caused for the most part by the burning of the carbon. It is to be noted that the highest tensile strength for remelted pig-iron was found with a total carbon content of 2.56 per cent. in accordance with the results obtained with the samples Nos. 10, 11 and 13.

(*b*) *Influence of Casting Temperature.*—The influence of the casting temperature upon the strength has been investigated by many authors,

* Foundry Trade Journal, 1927, pp 199/202.

(*Continued on page* 136.)

Table VI.

Raw material.		Highest Test Value.				Lowest Test value.			
		Test value.	Temp. deg. C.	T.C. per cent.	Gr. Per cent.	Test value.	Temp. Per cent.	T.C. Per cent.	Gr. Per cent.
Cylinder iron:— T.C. = 3.00 .. C.C. = 0.80 .. Gr. = 2.20 .. Si. = 1.64 .. Mn. = 0.56 .. P. = 0.42 .. S. = 0.071 ..	Transverse strength ..	32.9 t/sq. in.	1,350	2.98	2.21	31.1 t/sq. in.	1,310	2.97	2.20
	Tensile strength	19.0 t/sq. in.	1,350	2.98	2.21	17.2 t/sq. in.	1,260	3.00	2.20
	Hardness	138.0 t/sq. in. ..	1,425	2.95	2.20	130.0 t/sq. in.	1,490	3.01	2.27
	Impact strength ..	47.6 ft. lbs./sq. in. ..	1,520	2.92	2.17	42.0 ft.-lbs./sq. in. ..	1,310	2.97	2.20
	Deflection	0.413 in.	1,490	3.01	2.27	0.354 in.	1,260	3.00	2.20
Pig-iron remelted:— T.C. = 2.73 .. C.C. = 0.53 .. Gr. = 2.00 .. Si. = 1.64 .. Mn. = 0.80 .. P. = 0.054 .. S. = 0.026 ..	Transverse strength ..	30.5 t/sq. in.	1,610	2.23	1.45	26.1 t/sq. in.	1,410	2.60	1.88
	Tensile strength	20.8 t/sq. in.	1,455	2.56	1.83	16.7 t/sq. in.	1,280	2.73	2.00
	Hardness	149.0 t/sq. in.	1,550	2.37	1.62	139.0 t/sq. in.	1,280	2.73	2.00
	Impact strength	57.3 ft.-lbs./sq. in. ..	1,360	2.82	1.93	43.8 ft.-lbs./sq. in. ..	1,610	2.23	1.45
	Deflection	0.319 in. ..	1,455	2.56	1.83	0.236 in.	1,410	2.60	1.88
Engineers' quality:— T.C. = 3.45 .. C.C. = 0.87 .. Gr. = 2.58 .. Si. = 1.39 .. Mn. = 0.42 .. P. = 0.56 .. S. = 0.087 ..	Transverse strength ..	30.1 t/sq. in.	1,470	3.32	2.36	26.2 t/sq. in.	1,340	3.41	2.66
	Tensile strength	18.3 t/sq. in.	1,600	2.94	1.83	14.2 t/sq. in.	1,270	3.45	2.58
	Hardness	152.0 t sq. in.	1,600	2.94	1.83	117.0 t/sq. in.	1,340	3.41	2.66
	Impact strength ..	48.5 ft.-lbs./sq. in. ..	1,470	3.32	2.36	40.6 ft.-lbs./sq. in. ..	1,340	3.41	2.66
	Deflection	0.409 in.	1,415	3.34	2.44	0.315 in.	1,600	2.94	1.83

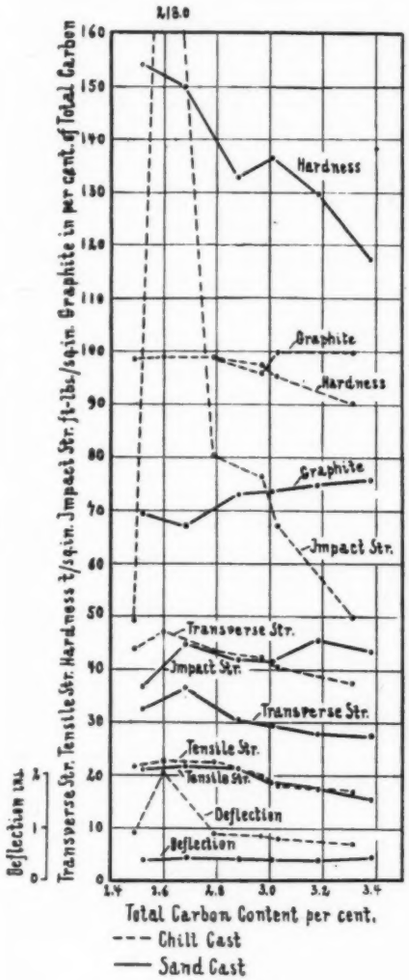


Fig. 4.

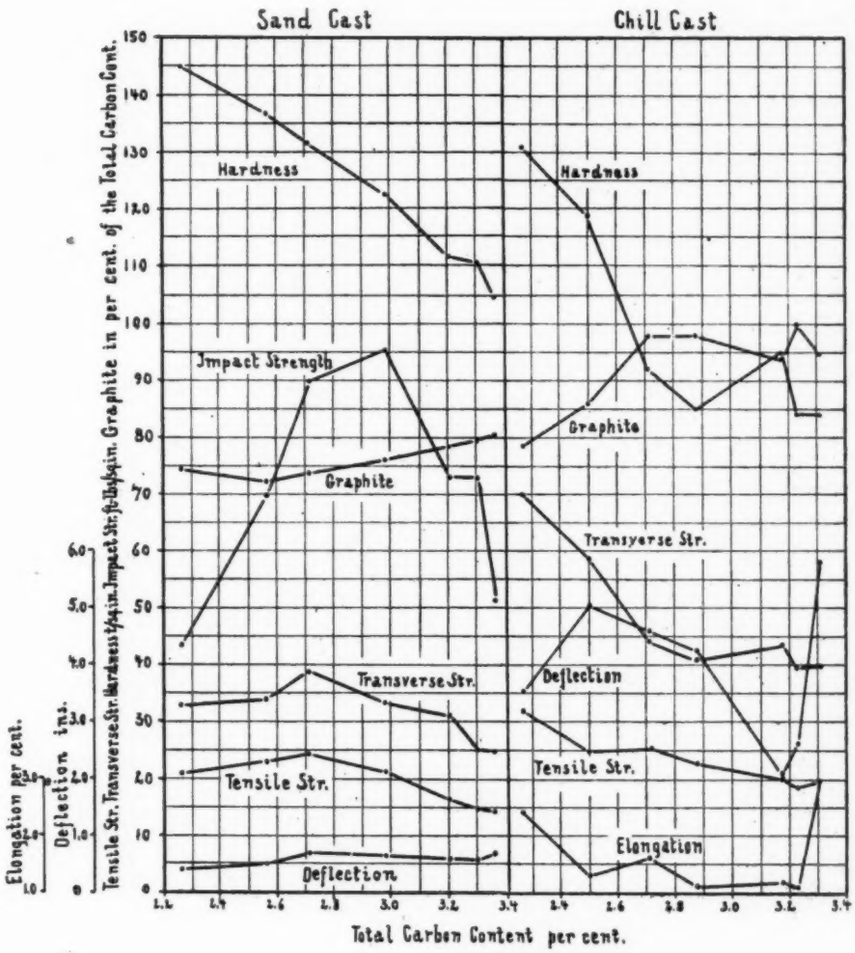


Fig. 5.

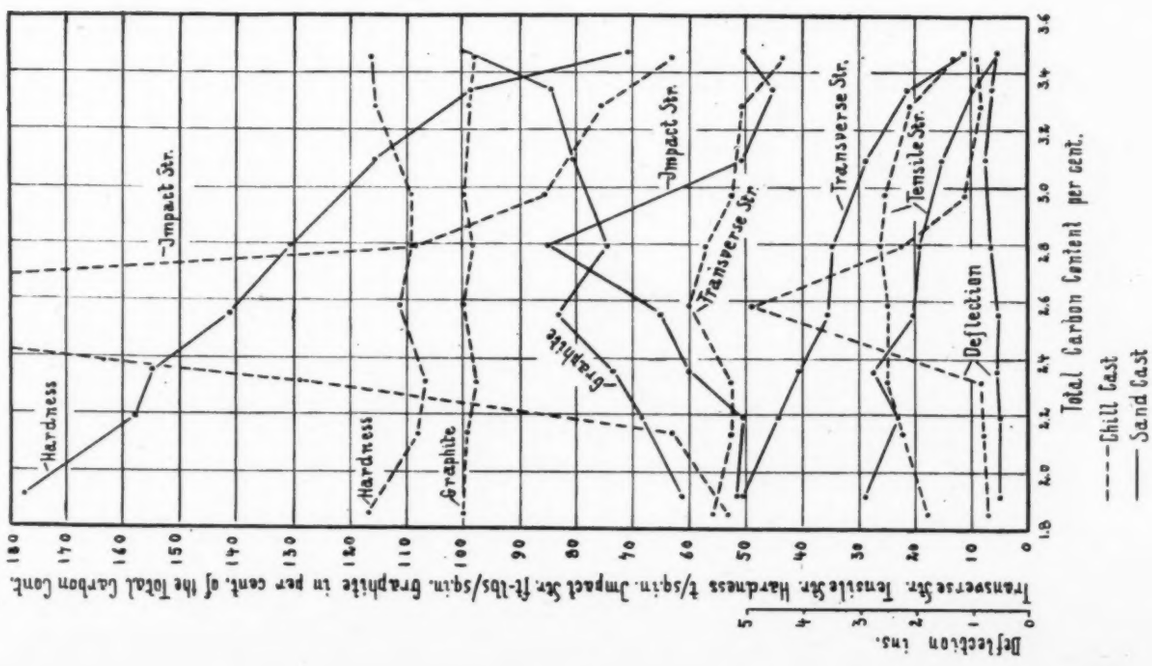


Fig. 6.

Factors in Mechanisation Studies.*

By J. J. Hartley.

Various computations have been made showing that it is necessary to handle or rehandle from 150 to 200 tons of material to produce one ton of castings in the average foundry. It is therefore evident that materials handling is a major item of foundry cost and improved methods or short cuts which reduce this cost and tonnage ratio will result in lower cost of product.

"Continuous Process" Foundries.

The most startling economies can and have been made in the shops doing repetitive work which we will call "continuous process" foundries. Some of them to-day closely approach the ultimate in which a moulder does nothing but mould, a pourer nothing but pour, etc., etc., and the resulting straight line operations lend themselves admirably to low-cost production through the installation of highly-specialised handling-devices.

Their problem of justifying the cost of an investment in materials handling equipment is comparatively easy, as the tremendous production attainable in these continuous units will rapidly "pay out" the most expensive special handling equipment.

This does not mean that such shops can select their materials handling equipment haphazardly. The utmost care and planning are essential to co-ordinate the equipment with other units and the production requirements of the plant. Every precaution must be taken to insure continuity of operation as a tie-up or breakdown of any part is costly and affects production schedules seriously. Again it may be said the returns from such installations justify a well organised maintenance force and the replacement of worn parts before breakdowns occur.

"Continuous process" foundries usually equip with mechanical handling devices from the receiving of their raw materials to the shipment of finished product, and many of the savings effected are intangible unless determined over at least a year or more operations. We refer to such factors as:—(1) Multiply value of floor space (reduce taxes, insurance, maintenance and depreciation of buildings per ton produced); (2) better sand control (reduces labour cost of sand preparation and lower losses generally); (3) lower stocks (cuts flask and pattern equipment materially, whilst high speed production lowers the quantity of plant for the work in progress), and (4) fewer accidents (straight line operations and elmination of manual handling reduces accidents).

The above refers to intangible savings only, and no attempt will be made to outline the tangible items for fear of entering into a discussion on the various types of equipment. Suffice it to say, it has been proved that a "continuous process" foundry under normal operations will save the cost of its materials handling equipment in a remarkably short time by the savings on direct and indirect labour alone, without regard to the above factors.

Table II.—*Amount that may be Spent for each £1 per Ton Reduction in Cost, using 20 per cent. per Year Fixed Charges.*

Annual Earnings in per-centage.	Annual Production in Tons									
	1,000	2,000	3,000	5,000	10,000	20,000	30,000	40,000	50,000	60,000
	£	£	£	£	£	£	£	£	£	£
100	833	1,660	2,493	4,165	8,330	16,660	24,990	33,320	41,650	49,980
50	1,428	2,856	4,284	7,140	14,280	28,560	42,840	57,120	71,400	85,680
33⅓	1,875	3,750	5,625	9,375	18,750	37,500	56,250	75,000	93,750	112,500
25	2,222	4,444	6,666	11,110	22,220	44,440	66,660	88,880	111,100	133,320
20	2,500	5,000	7,500	12,500	25,000	50,000	75,000	100,000	125,000	150,000

"Intermittent Process" Foundries.

This class of foundries has cast longing eyes at the low cost production of the continuous shops, and in a few cases have tried to adapt this very specialised handling equipment to their conditions, sometimes with dire results. Others by proceeding with discretion and sound judgment have successfully applied materials handling equipment to their intermittent processes and effected economies in handling raw materials, sand preparation, refuse disposal, casting handling, etc.

Flexibility of equipment is apparently the keynote for successful application of mechanical devices in such shops. In many cases these foundries serve outside interests and are subject to radical changes and wide variation in size and type of product. Their problem is therefore best solved by the use of standardised handling devices of the portable or semi-portable type.

Determining Returns.

Practically the same principles should be applied to both the "Continuous" and "Intermittent" foundries to determine when it is profitable to invest in materials handling equipment.

Individual managements have widely different ideas on what may be considered an acceptable rate of return on capital investments, and the following simple table is arranged to cover a rather wide range from 100 per cent. down to 20 per cent. annual return.

Disregarding any complicated accounting methods, such as interest earned on depreciation reserve fund, etc., and based on a 300 days operating year, allowing 20 per cent. for fixed charges, we have determined the amount it is practical to spend for each 1s. per day earnings of the equipment, as shown in the following Table:—

Table I.	1s.
Earnings or saving per day	1
One year or 100 per cent. return	250
Two years or 50 per cent. return	428
Three years or 33⅓ per cent. return ..	562
Four years or 25 per cent. return	666
Five years or 20 per cent. return	750

For example, say there exists a condition in the handling of materials, which now requires three men, each earning 10s. per day, and by some rearrangement and the installation of a conveyor, crane, truck or other device costing £1,000, this operation could be made a one-man proposition, thereby saving the pay of two men or £1 per day. This sum, minus the operating cost of, say, 3s. per day, gives a net earning of 17s. From the table we find that a 17s. per day saving will "pay out" a £363 16s. investment in two years. To the average management with sufficient working capital such a proposition would be very attractive and would no doubt be approved—providing the party suggesting the plan will stake his reputation on the figures and the success of the idea.

Many proposed schemes are much more complex than the simple example given above, especially those involving a change from "Intermittent Process" to "Continuous Process." Such a transition requires the most careful analysis and time studies to determine the potential earnings and application to the particular conditions. Many times it is preferable to compute these potential returns on a tonnage basis to arrive at the yearly earnings. Table II has been found useful in determining the feasibility of installing materials handling equipment when the estimated reduction in cost per ton has been determined.

From this table it may be readily determined that on a 10,000 ton yearly production a cut in cost of £5 per ton would justify an expenditure of £8,330 × 5 = £41,650 for 100 per cent. annual return, or £14,280 × 5 = £71,400 for 50 per cent. annual return, etc.

These tables are presented, not as examples of correct accounting methods, but as a short cut for determining the possibilities of a proposed materials handling installation. For accurate and definite methods of computing the economies of labour-saving equipment the Materials Handling Division of the A.S.M.E. have established formulæ that may be recommended.

While it is usual to compute the potential savings on the reduction in direct and indirect labour costs alone, sometimes the so-called intangible items assume great importance, and are entitled to major consideration. For instance, one rather modest continuous unit that earned practically its entire cost the first year by the reduction in flask equipment.

It is apparent that the problem of applying materials handling equipment and determining its earnings involve (*a*) Common-sense use of simple accounting methods; (*b*) co-ordination of the plan with production requirements; (*c*) careful estimating entire cost of proposed equipment; (*d*) conservative estimate on returns, differentiating between the definite and intangible items, and last but quite important; (*e*) a wideawake management with the necessary working capital and courage to back the plan.

* A Paper given under the title of "Determining Returns from Materials Handling Equipment" to the Philadelphia Meeting of the American Foundrymen's Association. The author is connected with the Link Belt Company, Chicago, Ill.

Graphite in Grey Cast Iron.

(*Continued from page* 134.)

but the results are contradictory. This may be explained by the fact that the highest temperature to which the iron was heated was not considered. Experiments were made with cupola iron which was poured at temperatures from 1,400 to 1,200 deg. C. from the same ladle. The compositions of the irons are given in Table VII. The transverse strength of the two irons showed a maximum value at 1,340 and 1,355 deg. C. respectively. The tensile strength of the special cast iron showed the highest value at 1,300 deg. C. Its influence upon the impact strength and the hardness could not be established. The graphite content was unchanged. The size of the graphite flakes was small at the highest temperature, and very coarse at the lowest temperature. This can be explained by the fact that with a high casting temperature the cooling rate is slow because of the preheating of the mould; therefore the molten iron is not cooled down below the freezing point and the rate of crystallisation is nearly the same in every direction, graphite crystals of a round shape are formed. With a very low casting temperature, on the other hand, the cooling rate is very high and the iron is kept in the liquid state below its freezing point. In this case the crystals chiefly grow in the direction where the rate of crystallisation is at a maximum resulting in forming long graphite flakes. Further experiments with cast iron superheated to 1,550 deg. C. showed that in this case the casting temperature has no influence upon the mechanical properties and the size of the graphite flakes.

Table VII.

Type of iron.	T.C.	C.C.	Gr.	Si.	Mn.	P.	S.
	%	%	%	%	%	%	%
Engineers' castings ..	3.59	0.72	2.87	1.82	0.69	0.49	0.116
Special ditto	3.37	0.80	2.57	2.38	1.14	0.46	0.10

(*c*) *Jolting the Iron Bath.*—The experiments were carried on with cupola iron of ordinary composition. The ladle containing the iron was clamped to a moulding machine of the jolting type and jolted for as long as 20 minutes. An influence upon the mechnical properties, the amount and the size of the graphite could not be stated. This result is in contradiction to the experiments made by Dechesne, who found an increase of the strength. But it must not be overlooked that the iron used by Dechesne contained a large amount of steel scrap (up to 70 per cent.), and the increase of the strength may be caused by the low carbon content of the mixture together with the higher melting temperature the jolting treatment only favouring a better mixing of the iron.

Notes on the Routine Analysis of Cast Irons and Iron Foundry Raw Materials—No. 2.

By Arthur Smith, M.A.

(*Continued from page* 117.)

Estimation of Silicon.

Silicon occurs in cast iron mostly in the form of silicides of iron or manganese. Pure iron will dissolve about 23 per cent. of silicon, but by using the electric furnace ferro-silicons can be prepared containing as much as 80 per cent. of silicon. Generally speaking, irons containing over 12 per cent. of silicon are ferro-silicons.

Ordinary cast irons will contain anything up to 4 per cent. silicon. Irons which contain between 4 per cent. or 12 per cent. are usually designated as high silicon irons.

Most of the methods used for the estimation of silicon in cast irons depend on the same principle, namely, the decomposition of the silicides of iron or manganese by mineral acids in which all the low silicon alloys are soluble and the subsequent conversion of the liberated silicic acid, silicon dioxide, in which form it is weighed. Some chemists prefer to dissolve the sample direct in hydrochloric acid alone, while others use nitric acid (sp. gr. 1.2) or a mixture of these acids followed by evaporation to dryness and baking to dehydrate silicic acid and render the resulting silicon dioxide insoluble. If done carefully a single evaporation should suffice, but care must be taken to ensure sufficient baking.. The residue is subsequently digested with dilute hydrochloric acid followed by immediate filtration through an ashless filter. The silicon dioxide plus graphite is retained on the filter, and after washing with dilute hydrochloric acid till free from iron and finally with hot distilled water, this residue is ignited in a platinum crucible at a temperature sufficiently high to burn off the graphite. The silicon dioxide is then weighed, but, as it is rarely pure, it should be treated by evaporation with sulphuric and hydrofluoric acids followed by ignition and weighing. The silicon dioxide is thus volatilised completely, and the difference between the weighings gives the amount of silicon (as silicon dioxide) in the sample. Care must be taken that the hydrofluoric acid is itself volatile. It is also important that the acid used for digesting the residue after baking should not be too concentrated, as this, as well as delay in filtering, will cause silicon dioxide to pass into solution. Although the above method is simple, in the hands of junior assistants, low results may be had because some of the silicon dioxide may remain in solution, and for routine work the writer prefers a modification of the nitro-sulphuric method originally described by Dr. Brown. It depends on the fact that when a nitric acid solution containing silicon dioxide is evaporated with sulphuric acid not only will the volatile nitric acid be expelled as vapour, but if the temperature is raised near to the boiling point of the concentrated sulphuric acid (judged by continuing the evaporation till fumes of sulphuric acid are given off) the silicon dioxide will become completely dehydrated and consequently insoluble.

Procedure for Routine Method.

Solutions required:—

(*a*) *Nitro-Sulphuric Acid.*—Mix 300 c.c.s. sulphuric acid (sp. gr. 1.84) with 480 c.c.s. nitric acid (sp. gr. 1.42) and 500 c.c.s. distilled water.

(*b*) *Dilute Hydrochloric Acid Wash.*—Dilute 100 c.c.s. of hydrochloric acid (sp. gr. 1.20) to a litre with distilled water.

Details of Method.—Weigh out 2 gms. for cast irons (or 2.351 gms. if factorial weighing is preferred, since Si O_2 contains 0.4702 Si). Add carefully 50 c.c.s. of the mixed acid to the sample in a 300 c.c.s. tall form pyrex, or similar beaker of heat-resisting glass, cover with a clock glass and heat gently on a sand bath and graphite hot plate until the sample is dissolved, then boil down rapidly on a hotter part of the bath or plate until the ferric sulphate separates out as a white mass. This heating must be continued until dense fumes are evolved. If the correct amount and ratio of the acid is adhered to, provided the evaporation is carried out with reasonable care, little trouble should be experienced with "spattering" and "spitting." Remove the beaker from the hot plate and allow it to cool. When cool add 150 c.c.s. distilled water and heat till all salts are dissolved. Stirring with a glass rod will aid solution; add 8 c.c.s. concentrated hydrochloric acid and heat for three minutes longer. This extra boiling will render the solution more easy to filter. Allow the Si O_2 and graphite to settle. Decant the clear solution through an 11 c.m. ashless filter, such as a Whatman No. 31 or similar porous grade and then transfer the precipitate. Filtration will be accelerated if the filter is first washed with boiling distilled water. Wash with hot distilled water, then with hot dilute hydrochloric acid till free from iron salts and finally with hot distilled water till free from acid.

Without previous drying transfer the filter to a suitable crucible. Platinum is the ideal material for such ignitions, but when a batch of twelve or more samples are being analysed simultaneously platinum is nowadays out of the question. Porcelain crucibles are satisfactory, but do not last long, and the writer would recommend Battersea clay annealing cups, as manufactured for gold assay work. These stand up well to repeated ignitions, but, of course, only platinum can be used when the SiO_2 is treated with HF. Although it is advisable to test the purity of the silicon dioxide by evaporation with HF. to volatilise the SiO_2 as SiF_4, the silicon dioxide obtained by the nitro-sulphuric method is nearly always pure. The chief impurity in the case of other methods will be titanium oxide, which, if present, readily passes into solution as titanic acid by the method just outlined. Consequently, where no HF. treatment is required the use of cheap but suitable crucibles becomes an economic necessity, and economy in the laboratory is as essential as economy in the production plant.

The method of igniting the SiO_2 + carbon residue is important. The initial heating should be carried out at a moderate heat (dull red), followed by a much higher temperature. Overheating to commence with will produce a peculiar physical condition, which renders the carbon very slow to oxidise. Filtration by suction is unnecessary, but the use of deeply cut filter funnels is a great advantage if the correct grade of filter paper is used.

The weight of SiO_2 in grams (if 2 gms. sample taken) obtained by direct weighing or by difference in the case of conversion to silicon tetrafluoride multiplied by 0.4702, multiplied by 50, gives the percentage of silicon in the sample. If 2.351 gms. sample has been taken then the weight of SiO_2 in milligrams, divided by 5, gives the silicon content in tenths of 1 per cent. The degree of accuracy aimed at should be such that check estimations agree within $\pm$ 0.05 per cent. in most cases and $\pm$ 0.02 when dealing with silicons under 1.0 per cent.

When the percentage of silicon is not too high and the sample has been reduced to a very fine powder, a three-acid mixture, *i.e.*, nitro-sulphuric with the addition of HCl will usually give complete solution and prolonged boiling with *aqua regia* followed by sulphuric acid, evaporation will prove effective. Samples containing over 12 per cent. silicon are usually best rendered soluble by fusing with sodium carbonate and subsequent treatment with H_2SO_4 to render SiO_2 insoluble.

The estimation of silicon is often added to alloying metals, such as nickel, for the purpose of lowering the melting point. In the case of silicon nickel alloys the standard method is applicable as nickel is readily soluble in nitro-sulphuric acid mixture.

The estimation of silicon in other ferro-alloys such as spiegeleisen, ferro-nickel, ferro-manganese ferro-chrome, etc., often call for modifications of the general methods, mainly on account of the difficulties which may arise in the decomposition of the alloys. Except in the cases of spiegeleisen and low-melting point ferro-nickels containing appreciable amounts of silicon, the estimation of silicon in ferro-alloys is usually of little importance. However, where the silicon is added with the definite intention of lowering the melting point of the alloy, the accurate estimation of the amount present may be very important indeed in order to determine exactly the economic and monetary value of the alloy.

Ferro-Chromium.—High-carbon alloys, which are the cheapest form of ferro-chromium alloys, have to be fused with sodium peroxide, but chromium metal and low-carbon ferro-chromium can be decomposed by means of hot dilute sulphuric acid. In the case of the latter, it is only necessary to dissolve a suitable weight of the finely powdered material in the necessary amount of dilute sulphuric acid (1: 4) in a beaker, and heat gently until decomposition of the alloy is complete. Evaporate the solution until fumes of H_2SO_4 just commence to be given off, avoiding overheating and prolonged "stewing," which may be the result of rendering the chromium salts difficult of solution. Allow the beaker and its contents to cool slightly, add 100 c.c.s. of hot distilled water, stir the residue to effect solution and boil until all chromium salts have been re-dissolved, and complete the estimation as for the nitro-sulphuric acid method for cast iron, taking care that the ignition is carried out at a high temperature.

In the case of high carbon ferro-chromium alloys it is necessary to fuse the very finely divided sample (it should be capable of completely passing a No. 90 sieve) in a pure silicon-free iron-crucible made from the purest Swedish ingot iron. For one-gram samples add approximately 10 gms. sodium peroxide, mix thoroughly, taking care to avoid loss, cover with 2 to 3 gms. sodium peroxide, and fuse contents by heating to 650 to 750 deg. (*i.e.*, a dull red heat). Continue to heat the mass after melting at the same temperature for a few minutes to ensure complete decomposition. Allow to cool and then place the crucible and contents in a large squat form beaker, adding 250 c.c.s. distilled water to dissolve the melt. Remove crucible, rinse with distilled water, transferring washings to beaker, add 80 c.c.s. dilute sulphuric acid (1: 4) and proceed as for low carbon.

Ferro-Chromium Alloys.—In most cases in the manufacture of nickel chromium cast irons the silicon content in ferro-chrome is negligible.

Ferro-Manganese or Spiegeleisen.

In the case of ferro-manganese, provided the sample has been crushed to a very fine powder, solution can readily be effected by the standard nitro-sulphuric mixture as used for cast irons, the completion of the estimation exactly following the standard method. For spiegeleisens, it will be found necessary to fuse the finely divided sample with sodium peroxide, and proceeding exactly as in the case of high-carbon ferro-chrome. As spiegeleisen is used as a medium for adding both silicon and manganese to cast iron, the estimation of silicon in this series of alloys is important, but in straight ferro-manganese alloys it is seldom necessary to worry about the silicon content for iron foundry work.

Ferro-Nickels and Silicon Nickel Alloys.

The above alloys have recently received much prominence in the cast-iron world on account of their use in the manufacture of nickel-chromium alloy cast irons, and, consequently, as it is often advantageous to use a low melting-point nickel alloy for addition to the stream of metal being tapped from the cupola or for direct ladle additions, the estimation of silicon in silicon nickel alloys such as the well-known "F" nickel alloy shot becomes important.

The author has found that quite accurate results can be obtained by using the standard nitro-sulphuric acid method, but the quantity of sample taken must be varied according to the amount of silicon present.

Mr. William Hunter, a director of Messrs. William Hunter & Company (Shettleston), Limited, sheet-iron workers, of Carntyne, Glasgow, died recently.

Trade Talk.

The Swedish iron ore miners' strike has now come to an end. The miners have accepted the proposals of the Mediation Commission and work will presumably resume before the end of August.

The Freyn Engineering Company, of Chicago, have received instructions from the Russian Soviet Government to construct an iron and steel plant at Kuznetzk, Siberia, capable of producing 400,000 tons of finished steel per annum.

On account of the holiday season and slackness of trade Messrs. Palmers Shipbuilding & Iron Company, Limited, Jarrow, have decided to damp down for a few months, until business is restored, their two blast furnaces now working.

Messrs. Harland & Wolff, Limited, launched last week from their Greenock shipyard the only vessel which they have on hand for construction at that establishment, and the yard will now be closed for an indefinite period.

The South African Manganese Company, Limited, does not intend to confine its activity to exporting manganese ore only from its Postmasburg deposit, but purposes to erect an electric furnace plant to manufacture ferro-manganese.

The National Radiator Company have decided to erect a large foundry at Dammarie-les-Lys, near Melun, France. The proximity to Paris, a very important market for radiators is said to be the governing condition for the choice of this site.

Meetings of the preference and ordinary shareholders of the Star Engineering Company, Limited, will be held at the Victoria Hotel, Wolverhampton, on August 29, to consider a scheme of arrangement between the company and the shareholders.

Messrs. Robert Stephenson & Company, Limited, recently received an order from Messrs. Thomas Summerson & Sons, Limited, of Darlington, for about 450 tons of B.S. 90-lbs. revised-section flat-bottom chrome-steel rails for the Great Indian Peninsula Railways.

The Ailsa Shipbuilding Company, Limited, of Troon and Ayr, have contracted to build for the General Steam Navigation Company, Limited, London, a single-screw steamer of 1,200 tons for their Continental trade. Triple-expansion engines will be supplied by the builders.

Sydney (N.S.W.) Civic Commissioners have accepted the tender of the General Electric Company, Limited, London, for an electric cable of 33,000 volts, 102,500 yards in length. The contract will also include the provision of a pilot cable 101,000 yards in length and jointing material. The cost will be £149,331.

A contract on behalf of Japanese iron and steel works has been concluded whereby Japan will receive tonnages of iron ore from Australia varying from 150,000 to 1,000,000 a year. A company formed by British capital has been formed at Yampi Sound, on the coast of Western Australia, to quarry the ore and place it on board Japanese steamers.

The Republic Iron & Steel Company, of Youngstown, Ohio, announces the acquisition of Steel & Tubes, Incorporated, of Cleveland, at an estimated price of $17,000,000 (£3,400,000), for the purpose of expanding the pipe-making facilities of Steel & Tubes, Incorporated. The respective directorates have approved of the merger through the exchange of securities, while the stockholders of Steel & Tubes, Incorporated, are expected to ratify the sale shortly.

The Broken Hill Proprietary Company is placing an order with the Coppée Company (Great Britain), Limited, London, for the construction of coke ovens and by-product plant at their steelworks at Newcastle, N.S.W. The cost of the new works will be £1,000,000. The Coppée Company, it is stated, will use exclusively British material when the necessary material is not available in Australia. The company will introduce specially skilled British technicians. Otherwise it will employ Australian labour and material.

The earnings of the Bethlehem Steel Corporation during the second quarter of 1928, after deducting all charges and dividends on preferred stock, were equal to $1.57 per share on common stock, as compared with $0.94 per share in the first quarter of 1928. The value of orders on hand on June 30, 1928, was $51,761,908, as compared with $61,393,488 at the end of the previous quarter. Operations averaged 82.5 per cent. of capacity during the second quarter, as compared with 79.5 per cent. during the previous quarter. Current operations are at the rate of approximately 75 per cent. of capacity.

According to a cable received from Johannesburg, Dr. van der Bijl, the Government nominee on the board of the South African Iron and Steel Corporation, has made a statement to the effect that the Corporation would pursue the fundamental object underlying its establishment, the provision of a key industry which would in turn aid and encourage the creation of subsidiary industries. It was wrong to suppose that the Corporation would undertake any engineering work. Their purpose would rather be to supply the engineering and allied trades with the raw materials, iron and steel, upon which those trades must be based. Regarding coal, provided the collieries supplied at reasonable prices the requisite quantity for coking, the Corporation was not disposed to embark upon coal mining, although it was empowered to do so. Dr. Bijl announced that the South African Government is to contribute £500,000 in connection with the project.

Sir W. Peter Rylands presided at an extraordinary general meeting of the Pearson and Knowles Coal and Iron Company, Limited, in London, on August 13, when the resolutions passed at the meeting held on July 27 for the reduction of the capital and the conversion and alteration of the shares and the articles of association of the company were confirmed. At a subsequent extraordinary general meeting of the Partington Steel & Iron Company, Limited, Sir W. Peter Rylands again presiding, the resolutions passed at the meeting held on July 27 for the reorganisation of the capital of the company were confirmed. Although a majority of the first debenture stockholders of the Pearson & Knowles Company have agreed to the proposals for the reorganisation of the finances of the company, some dissatisfied holders have appointed a committee to look after their interests, and talk of opposing the plan when it comes before the Court. The dissentient stockholders, who are said to include representatives of three Investment Trust Companies, have sent a questionnaire to all the first debenture stockholders asking if they are satisfied with the terms and whether they are willing to contribute towards the expenses of opposing the scheme.

The adjourned meeting of the holders of the 5 per cent. (income-tax free) first debenture stock of the Barrow Hematite Steel Company, Limited, held on August 14 in London, to consider the financial proposals of the directors, was, after a long discussion, further adjourned until September 14 next. Mr. C. G. Hamilton, one of the trustees for the debenture-holders, who presided, said that since the last meeting many discussions had taken place between the directors of the company and the others interested, and the directors had submitted a new proposal, the effect of which was that the company, having made arrangements for further finance without the necessity of any prior lien debenture issue, it was proposed that the debenture stockholders should agree to a moratorium in respect of interest until June 30, 1929, and that the company should render statements of receipts and payments and of the financial position of the company monthly during the moratorium to the advisory committee, and if they certified at any time that the interests of the debenture stockholders were in jeopardy, the debenture stockholders were to be at liberty to apply for a receivership, which the company would not oppose; the company were also to prepare and present before the expiration of the moratorium a capital reconstruction scheme for the consideration of all parties concerned. The Debenture Corporation, which had been the leader of the opposition raised to the creation of a prior lien debenture, having considered the proposals of the company, had made counter-proposals which included the reconstitution of the board of that and of another company. Those counter-proposals the directors were not prepared to accept. In view of the diverse views expressed, and with the object of avoiding, if possible, the appointment of a receiver, he (the chairman) would suggest that the meeting should be further adjourned for the purpose of making a final endeavour to come to an arrangement which would be acceptable to all parties. Mr. G. Mure Ritchie, in response to a request for details as to the present position of the company, said that the various departments were all working, and surveying the whole of the probable operations for the next few months, assuming the moratorium to be granted, there was little or no reason to suppose that the company would not come out on the right side at the end of the year.

New Companies.

Barronia Metals, Limited, 59, Parsons Green Lane, London, S.W.6.—Capital £50,000. Iron, steel, brass and other metal makers and founders, etc. Directors: J. C. Moulder, Sir James Curtis, I. L. Orr Ewing, W. Webster, S. G. T. Earle and F. J. Bullen.

Henry Wilson (Birmingham), Limited, 36 and 37, George Street Parade, Birmingham.—Capital £15,000 in £1 shares, to acquire the Birmingham branch of the business now carried on by Henry Wilson (Birmingham and Bradford), Limited, at 36-7, George Street Parade, Birmingham, and to carry on the business of brass and iron founders, merchants, importers and exporters, etc.

Personal.

Mr. H. E. Lewis, Vice-President of the Bethlehem Steel Corporation, is at present in Europe on a business trip.

Dr. R. J. Anderson, the well-known American metallurgist, has left London for Russia, where he will remain until early October.

Mr. H. R. Hire, of the Hire Foundry Company, Peoria, Ill., has been elected president of the recently organised Central Illinois Foundrymen's Club.

Sir Arthur J. Dorman, Bt., chairman of Messrs. Dorman, Long & Company, Limited, Middlesbrough, celebrated his eightieth birthday on Wednesday, August 8.

Mr. J. Ivan Spens, who is a partner in Messrs. Brown, Fleming & Murray, chartered accountants, has accepted an invitation to join the board of the United Steel Companies, Limited.

Mr. J. V. Ellis has resigned his position as a director of the United Steel Companies, Limited, and manager of the West Cumberland properties of the company, including the iron and steel works at Workington.

Mr. Arthur Smith, a director of Messrs. Dean, Smith & Grace, Limited, ironfounders and lathe manufacturers, of Keighley, and chairman of the Keighley Higher Education Sub-committee, has been invited by Lord Eustace Percy, President of the Board of Education, to become a member of the Committee being set up by the Board of Education to consider the problem of technical education for the engineering industry.

Wills.

Knight, C. A., consulting engineer, lately a director of Messrs. Babcock & Wilcox, Limited £309,488

Obituary.

Mr. Henry Green, of 6, Endcliffe Hall Avenue, Sheffield, managing director of Willford & Company, Limited, railway spring manufacturers, Park House Works, Effingham Road, Sheffield, died on Monday, at the age of 71.

Mr. Edward J. Shaw, principal of the firm of E. J. Shaw & Company, brassfounders, Walsall, died suddenly on Saturday, August 11. He was a former president of Walsall Chamber of Commerce, and had been a magistrate in Walsall since 1896.

Mr. Herbert Eccles, J.P., the first chairman of the South Wales Siemens Steel Association, and one of the founders of the conciliation board in the trade, died at Swansea on Sunday, August 12. He was an ex-High Sheriff of Carmarthenshire and one of the best-known men in the South Wales steel and tinplate trades. A native of Leeds, born 71 years ago, he settled in South Wales as manager of the works of the old British Copper Miners' Company at Cwmavon, where he remained for several years. Thirty years ago, in company with Mr. F. F. Card, he acquired land at Briton Ferry and they started the Briton Ferry Steel Works. In addition to being chairman of this company, Mr. Eccles was also associated with the Llanelly Steel Works, which he assisted in forming, and he was a director of the owning company, the Llanelly Steel Company (1907), Limited. With Mr. Card he reconstructed the old Vernon Tinplate Works at Briton Ferry. He was also a director of the Melyn Tinplate Company, Limited, Neath, and the Baglan Engineering Company, Limited, Briton Ferry, and was connected with other tinplate concerns. In 1914 Mr. Eccles acquired the Albion Steel Works, Briton Ferry. He was the first chairman of the South Wales Siemens Steel Association, and in conjunction with Mr. John Hodge, he was responsible for the formation of the Joint Conciliation Board of the South Wales Siemens steel trade. He was a generous benefactor to charitable institutions, and was one of the founders of the Society of Yorkshiremen in South Wales.

Contracts Open.

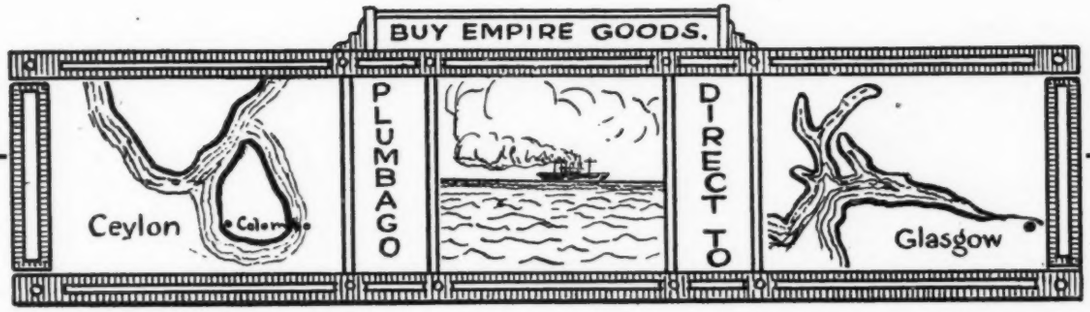
Cairo, October 1.—250 ornamental electric lamp standards, for the Tanzim Department of the Egyptian Ministry of Public Works. The Department of Overseas Trade. (Reference B.X. 4635.)

Constantinople, September 17.—30 road rollers, to be driven by mazout, for the Ministry of Public Works. The Department of Overseas Trade. (Reference A.X. 6691.)

Johannesburg, September 1.—Bucket conveyor and elevator, for the Town Council. The Department of Overseas Trade. (Reference A.X. 6653.)

London, S.E., September 4.—Five locomotive tank engines, for the India Stores Department, Lambeth, S.E.1. (Fee 5s., non-returnable.)

XUM



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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—Still largely influenced by the prevailing holiday spirit, business passing in the Cleveland iron market during the current week has been reduced to negligible dimensions and conditions are unlikely to be disturbed until September is well advanced and the end of the quarter period is nearer. That the depression existing in the Tees-side area is common to the industry generally is convincingly demonstrated by the report issued by the National Federation of Iron and Steel Manufacturers, estimating the production of pig-iron at 537,800 tons in July, compared with 563,700 tons in June and 645,800 tons in July, 1927. The production included 168,100 tons of hematite, 201,600 tons of basic, 130,800 tons of foundry, and 23,200 tons of forge iron. Hopes are, however, entertained of an expansion of home demand in the near future, negotiations now pending for a large contract for Cleveland iron delivered into Scotland appearing to be approaching completion, and its renewal might have a considerable effect on the market. But consumers are still hesitant regarding prices and are content to await the course of events. Meanwhile the ruling quotations both for home deliveries and for export are as follow:—No. 1 Cleveland foundry iron, 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; No. 4 forge iron, 64s. 6d. per ton.

The starting of another furnace at Redcar will increase to eight the number of blast furnaces producing East Coast hematite, and as there is rather more inquiry, perhaps this number is not sufficient wholly to meet current requirements. Thus makers' stocks are dwindling, and as the position improves so are prices inclined to stiffen. At present it is less easy to find a seller of mixed numbers below 70s. per ton. On the North-West Coast, Bessemer mixed numbers continue firm at 68s. per ton at works.

LANCASHIRE.—A slightly more active demand has been noted in local markets for foundry pig during the current week, while a few contracts on forward account are also reported as having been completed. Undercutting among Midland makers for orders in this district is less pronounced than it has been, the general range of quotations for Derbyshire and Staffordshire irons being from 67s. 6d. to 68s. per ton, including delivery to consumers in the area, while North-East Coast makers adhere to their 79s. level, with Scottish at from 87s. 6d. to 90s., according to quantity and brand.

THE MIDLANDS.—Foundries in the Black Country are experiencing rather a lean time at present, and are consequently buying on a limited scale in the local markets for pig-iron, only a few orders for prompt delivery being recorded recently, while forward business is temporarily in abeyance. Quotations remain unaltered as follow:—Northamptonshire No. 3, 55s.; Derbyshire No. 3, 59s. to 60s.; and North Staffordshire No. 3 60s., all f.o.t. furnaces.

SCOTLAND.—Scottish pig-iron makers find the demand still very slow, but the position begins to show signs of a development so far as supplies are concerned. The furnaces which are damped down still have good stocks, but are inclined to quote a little higher price. The only exception is Glengarnock No. 3 quality, which is now almost unobtainable.

Finished Iron.

At Birmingham this week market operations in all classes of finished materials were again in limited volume, and at the moment there is insufficient work to keep mills regularly occupied. Orders for crown iron are particularly difficult to obtain, and there continues very keen competition between the Lancashire, Derbyshire and Staffs. houses for this class of iron. Prices continue to vary, and crown iron is offered at any figure from £9. Nut and bolt iron from local works is offered at about £8 17s. 6d., but can be obtained from outside sources in some cases at 5s. below this. There is a stiffening in the price of Belgian No. 3, but the figures now quoted are well below the local price for nut and bolt iron, so that the majority of orders will still go abroad. There is no change in the price of Staffordshire marked bars at £12 basis at works. Orders coming through at present do not represent any bulk tonnage, and the makers are anything but satisfied with the position.

Steel.

At Sheffield this week there has been a slightly better feeling in evidence. Although the demand for acid billets is below the normal for this time of year, the inquiry begins to improve, while a fairly satisfactory business keeps up in basic billets, all at the old prices. Contracts with Continental firms are beginning to run out, and in view of the higher prices now ruling abroad buyers are coming back to their old suppliers. Some slight shading of Continental prices is reported, but this has not had the effect of stimulating business. Most of the Continental steel manufacturers claim that they have sufficient business on their books to keep them well employed for some time ahead. The tinplate market continues steady, with coke tins at 18s. to 18s. 3d. basis, net cash, f.o.b. Welsh ports.

Scrap.

Reports from the various centres of the scrap metal trade disclose only an indifferent demand for foundry material, influenced doubtless by the fact that many works have suspended deliveries over the holiday month. At Middlesbrough this week heavy cast iron is rather weaker, current quotations of 60s. and 65s. per ton respectively for ordinary and machinery qualities representing a drop of 1s. per ton. In Scotland heavy machinery cast-iron scrap remains firm at 65s. to 66s. 6d. and ordinary quality material to the same specification, 61s. 6d. to 62s. 6d. Old cast-iron railway chairs are rather scarce at 65s. to 67s., all per ton delivered f.o.t. works.

Metals.

Copper.—The consistent steadiness maintained in warrant copper values during the past few months continues undisturbed, quotations varying only to a trifling extent from week to week, with, so far, little indication of any marked changes in the near future. Sales in the United States during July are reported to have totalled nearly 50,000 tons, of which roughly 50 per cent. was for domestic consumption, and the significance of these figures may quite easily have a marked effect on European price fluctuations, especially if there should be an early return to normal market activity.

Closing quotations are :—

Cash.—Thursday, £62 7s. 6d. to £62 10s.; Friday, £62 7s. 6d. to £62 8s. 9d.; Monday, £62 8s. 9d. to £62 10s.; Tuesday, £62 7s. 6d. to £62 8s. 9d.; Wednesday, £62 7s. 6d. to £62 8s. 9d.

Three Months.—Thursday, £62 17s. 6d. to £62 18s. 9d.; Friday, £62 17s. 6d. to £62 18s. 9d.; Monday, £62 17s. 6d. to £63; Tuesday, £62 16s. 3d. to £62 17s. 6d.; Wednesday, £62 16s. 3d. to £62 17s. 6d.

Tin.—Values of standard cash tin continue irregular, the position at last week's close again disclosing a weaker tendency. On the probable future course of the market there is still considerable divergence of opinion. The immediate outlook is rendered uncertain by reports of heavy supplies shortly coming to hand, and by some temporary slackness in the tinplate industry, but the position as a whole is rather more hopeful from the producers' point of view.

Official closing prices :—

Cash.—Thursday, £214 to £214 5s.; Friday, £215 15s. to £216; Monday, £212 10s. to £212 15s.; Tuesday, £211 17s. 6d. to £212; Wednesday, £211 10s. to £211 15s.

Three Months.—Thursday, £209 7s. 6d. to £210; Friday, £211 to £211 5s.; Monday, £208 to £208 5s.; Tuesday, £207 15s. to £208; Wednesday, £208 to £208 5s.

Spelter.—The market for ordinary spelter remains slow, but with a slightly better demand from the galvanising industry, the tendency of values has taken an upward turn, the quotations are mostly firmer. In view of the position revealed by the American statistics for July, it seems probable that this movement will be continued. The American figures were particularly interesting in that they revealed a decrease of 2,258 tons in stocks and a reduction of 3,300 in the number of retorts operating.

Daily quotations are :—

Ordinary.—Thursday, £24 13s. 9d.; Friday, £24 12s. 6d.; Monday, £24 5s.; Tuesday, £24 8s. 9d.; Wednesday, £24 6s. 3d.

Lead.—The improved demand for lead has been quite an outstanding feature of operations on the London Metal Exchange of late. Values have moved steadily upwards, and at the close show a substantial advance on quotations ruling at the end of July. For this increase renewed buying activity is probably only partially responsible, the decision to call a world-wide conference of lead interests early in September having had a marked effect on market sentiment.

Closing prices :—

Soft Foreign Prompt.—Thursday, £22; Friday, £21 18s. 9d.; Monday, £21 13s. 9d.; Tuesday, £21 12s. 6d.; Wednesday, £21 17s. 6d.

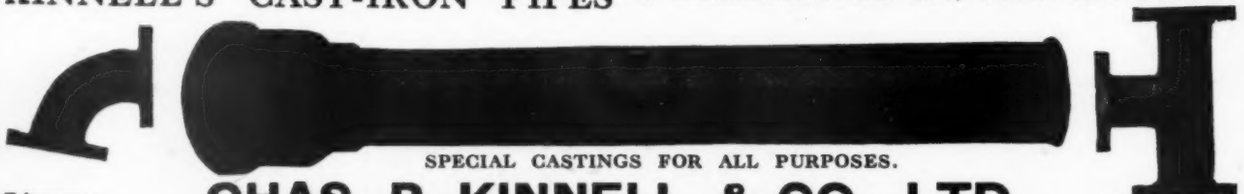
Halifax Foundry Reopened.

As briefly announced last week, Messrs. George Cohen, Sons & Company, Limited, of London, the new owners of the Campbell Gas Engine Company, of Halifax, are making a thorough and careful investigation of the situation with a view to determining the best course to pursue in regard to their West Riding acquisition, and in this connection they have restarted the foundry and made a beginning with the work of manufacturing fifty oil engines, ranging in power from 3 to 40 horse-power.

This work will involve the employment of probably not more than 150 men, but it is a good augury of the firm's intentions at Halifax that the majority of these engines are to be made simply for the purpose of replenishing depleted stocks. Others are to be made in the fulfilment of orders.

American Iron and Steel Institute's Statistical Report for 1927.—Several new tables appear in the 1927 Annual Statistical Report of the American Iron and Steel Institute. Principal among these are tables relating to foreign countries. Seven pages of production figures for the principal producing countries cover iron ore, pig-iron, ferro-alloys and steel ingots and castings. These are for more than 20 countries, and, so far as data are available, they are for all the elapsed years of the current century. Eight pages of new data cover, for 1923 to 1927, inclusive, exports of various leading iron and steel products from the United States to the principal consuming countries beyond the borders.

KINNELL'S CAST-IRON PIPES & CONNECTIONS FOR GAS, WATER AND STEAM.



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Sterling

SOLID RIBBED ROLLED STEEL

MOULDING BOXES

are recognised as Standard Box equipment by the majority of the leading foundries and engineering establishments in this country and overseas.

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WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash ..	62	7	6
Three months ..	62	16	3
Electrolytic	68	15	0
Tough	64	15	0
Best selected ..	65	0	0
Sheets	94	0	0
India	76	15	0
Wire bars	69	5	0
Do. September ..	69	5	0
Do. October ..	69	5	0
Ingot bars	69	5	0
H.C. Wire rods ..	73	7	6
Off. av. cash, July ..	62	18	4 5/12
Do. 3 mths., July ..	63	3	9
Do., Sttlmnt., Jluy	62	18	3 11/12
Do., Electro, July ..	68	18	4 1/12
Do., B.S., July ..	66	3	7 1/2
Aver. spot price, copper, July	62	18	4 1/2
Do., Wire bars, July	69	3	5
Solid drawn tubes			13 1/4d.
Brazed tubes			13 1/4d.
Wire			10d.

BRASS.

Solid drawn tubes	11 1/2d.
Brazed tubes	13 1/2d.
Rods, drawn	10 1/2d.
Rods, extd. or rlld. ..	7 1/2d.
Sheets to 10 w.g. ..	10 1/2d.
Wire	9 1/2d.
Rolled metal	9 1/2d.
Yellow metal rods	7 1/2d.
Do. 4 × 4 Squares ..	8d.
Do. 4 × 3 Sheets ..	8 1/2d.

TIN.

		£	s.	d.
Standard cash ..		211	10	0
Three months ..		208	0	0
English		211	0	0
Bars		212	0	0
Straits ..	(Nom.)	214	17	6
Australian ..	(Nom.)	213	0	0
Eastern		211	10	0
Banca	(Nom.)	218	17	6
Off. av. cash, July ..		212	10	11 3/20
Do., 3 mths., July		209	14	10 7/10
Do., Sttlmt., July		212	10	2 5/10
Aver. spot, July ..		212	10	11 1/2

SPELTER.

		£	s.	d.
Ordinary		24	6	3
Remelted		23	0	0
Hard		19	10	0
Electro 99.9		28	0	0
English		24	15	0
India		21	5	0
Zinc dust ..	(Nom.)	35	0	0
Zinc ashes		7	15	0
Off. aver., July ..		24	19	2 5/10
Aver., spot, July ..		24	18	11

LEAD.

		£	s.	d.
Soft foreign ppt. ..		21	17	6
English		23	5	0
Off. average, July ..		20	15	5 3/10
Average spot, July ..		20	11	11 1/2

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English ..	33	0	0
Do. V.M. ex whf. ..	31	5	0
Rods	39	0	0
Boiler plates	29	0	0
Battery plates ..	30	10	0

ANTIMONY.

	£	s.	d.
Special brands, Eng. ..	59	0	0
Chinese	39	10	0
Crude	33	10	0

QUICKSILVER.

	£	s.	d.
Quicksilver	23	0	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

		£	s.	d.
Ferro silicon—				
25%		8	0	0
45/50%		12	5	0
75%		19	7	6
Ferro-vanadium—				
35/50%	..14/- lb. Va.			
Ferro-molybdenum—				
70/75% c. free ..	..4/3 lb. Mo.			
Ferro-titanium—				
23/25% carbonless ..	1/2 lb.			
Ferro-phosphorus, 20/25%	£18	0	0	
Ferro-tungsten—				
80/85%, c. fr.	1/3 lb.			
Tungsten metal powder—				
98/99%	1/7 1/2 lb.			
Ferro-chrome—				
2/4% car.	£30	0	0	
4/6% car.	£21	10	0	
6/8% car.	£20	15	0	
8/10% car.	£20	2	6	
Ferro-chrome—				
Max. 2% car.	£33	0	0	
Max. 1% car.	£38	0	0	
Max. 0.70% car.	£44	0	0	
70% carbonless	1/1 lb.			
Nickel—99% cubes or pellets	£175	0	0	
Ferro-cobalt	9/- lb.			
Aluminium 98/99% ..	£100	0	0	
Metallic chromium—				
96/98%	2/8 lb.			
Ferro-manganese (net)—				
76/80% loose	£13	15	0	
76/80% packed	£14	15	0	
76/80% export	£13	10	0	
Metallic manganese—				
94/96% carbonless ..	1/6 lb.			

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0	2	3
Finished bars, 18% tungsten	£0	2	9

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under 1/2 in. to 1/4 in.	3d. lb.
Do., under 1/4 in. to 1/8 in.	1/- lb.
Flats, 1/2 in. × 1/4 in. to under 1 in. × 1/2 in.	3d. lb.
Do., under 1/2 in. × 1/4 in. ..	1/-lb.
Bevels of approved sizes and sections	6d. lb.
Bars cut to length, 10% extra.	

Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf ..	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Hvy. steel	3	8	0			
Bundled steel and shrngs. ..	3	2	6	to 3	6	6
Mixed iron and steel ..	3	0	0	to 3	2	6
Heavy cast iron	2	15	0	to 2	17	6
Good machinery for foundries	3	2	6			
Cleveland—						
Heavy steel	2	15	0			
Steel turnings	2	7	6			
Cast iron borings ..	2	4	0			
Heavy forge	3	10	0			
Bushelled scrap	3	0	0			
Cast-iron scrap	3	2	6			
Lancashire—						
Cast-iron scrap	3	0	0			
Hvy. wrought	2	17	6			
Steel turnings	2	2	6			

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	52	0	0
Brass	37	0	0
Lead (less usual draft) ..	18	0	0
Tea lead	16	0	0
Zinc	15	0	0
New aluminium cuttings ..	66	0	0
Braziery copper	47	0	0
Gunmetal	47	0	0
Hollow pewter	150	0	0
Shaped black pewter ..	105	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	68/6
Foundry No. 3	66/6
Foundry No. 4	65/-
Forge No. 4	64/6
Hematite No. 1	70/6
Hematite M/Nos.	70/-
N.W. Coast—	
Hem. M/Nos. d/d Glas. ..	79/-
,, d/d Birm.	86/-
Midlands—	
Staffs. common*	67/6
,, No. 4 forge ..	56/-
,, No. 3 fdry. ..	60/-
Shrops. basic	—
,, Cold blast, ord.* ..	—
,, ,, roll iron* ..	—
* d/d Birmingham.	
Northants forge	51/6
,, fdry. No. 3 ..	55/-
Derbyshire forge	59/-
,, fdry. No. 3 ..	59/6
,, basic	60/-
Scotland—	
Foundry No. 1	76/-
,, No. 3	70/6
Hem. M/Nos.	74/-
Sheffield (d/d district)—	
Derby forge	62/6
,, fdry. No. 3 ..	64/6
Lincs. forge	62/6
,, fdry. No. 3 ..	64/6
E.C. hematite	78/6
W.C. hematite	83/6
Lines. (at furnaces)—	
Forge No. 4	58/-
Foundry No. 3	60/-
Basic	58/6
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3 ..	67/6
Northants foundry No. 3 ..	—
Dalzell, No. 3(special)	100/- to 102/6
Summerlee, No. 3 ..	87/6
Glengarnock, No. 3 ..	87/6
Gartsherrie, No. 3 ..	87/6
Monkland, No. 3 ..	87/6
Shotts, No. 3	87/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.	9	10	0	to 10	15	0
Nut and bolt iron	8	12	6	to 8	17	6
Hoops				11	10	0
Marked bars (Staffs.) f.o.t.				12	0	0
Gas strip				11	10	0
Bolts and nuts, 1 in. × 4 in.				15	5	0
Steel—						
Ship plates ..	8	7	6	to 8	12	6
Boiler plts.				10	10	0
Chequer plts.				10	12	6
Angles				7	17	6
Tees				8	17	6
Joists				7	17	6
Rounds and squares, 3 in. to 5 1/2 in.				8	17	6
Rounds under 3 in. to 1/2 in. (Untested)				7	15	0
				and upwards		
Flats, over 5 in. wide and up				8	7	6
Flats, 5 in. to 1 1/2 in. ..				7	17	6
Rails, heavy				8	10	0
Fishplates				12	10	0
Hoops (Staffs.)				10	0	0
Black sheets, 24g. ..				10	0	0
Galv. cor. shts., 24g. ..				13	10	0
Galv. fencing wire 8g. plain				12	10	0
Billets, soft	6	0	0	to 6	10	0
Billets, hard	7	2	6	to 7	12	6
Sheet bars				6	0	0
Tin bars				6	0	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 2 1/2
Sheet to 10 w.g.	1 3
Wire	1 3 1/2
Rods	1 3
Tubes	1 7 1/2
Castings	1 2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising ..	9d. to 1/3
Rolled—	
To 9 in. wide ..	1/3 to 1/9
To 12 in. wide ..	1/3 1/2 to 1/9 1/2
To 15 in. wide ..	1/3 1/2 to 1/9 1/2
To 18 in. wide ..	1/4 to 1/10
To 21 in. wide ..	1/4 1/2 to 1/10 1/2
To 25 in. wide ..	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5 1/2
Ingots rolled to spoon size	1/- to 1/8 1/2
Wire round—	
3/0 to 10 G.	1/6 1/2 to 2/1 1/2

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila. ..	20.26
No. 2 foundry, Valley	16.50
No. 2 foundry, Birm.	15.50
Basic	17.76
Bessemer	18.76
Malleable	18.76
Grey forge	18.01
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y at mill	43.00
Bess billets	32.00
O.-h. billets	32.00
O.-h. sheet bars	32.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.90
Tank plates	1.90
Beams, etc.	1.85
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.20
Sheets, black, No. 24	2.65
Sheets, galv., No. 24	3.40
Sheets, blue an'l'd., 9 and 10 ..	2.00
Wire nails	2.55
Plain wire	2.40
Barbed wire, galv.	3.20
Tinplates, 100 lb. box	$5.25

COKE (at ovens).

Welsh foundry	—
,, furnace	21/6
Durham and North.	
,, foundry	14/- to 14/6
,, furnace	14/-
Other Districts, foundry ..	—
,, ,, furnace (basis) ..	12/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes ..	20×14 box	18/- to 18/3	
,, ..	28×20	,, ..	36/3
,, ..	20×10	,, ..	27/-
,, ..	18 1/2×14	,, ..	18/9
C.W.	20×14	,, ..	17/-
,, ...	28×20	,, ..	34/-
,, ...	20×10	,, ..	21/9
,, ...	18 1/2×14	,, ..	15/6
Terneplates ..	28×20	33/6 per box basis f.o.b.	

SWEDISH IRON.

Bars, hammered, £17 10 0	to £18 10 0
Rolled Ord. ..	£15 0 0 to £15 10 0
Nail rods ..	£15 7 6 to £15 15 0
Keg. steel nom. ..	.. £33 to £35
Faggot steel nom. ..	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron ..	£5 15 0 to £6 0 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.
Up to and incl. 6 in.

	Tubes.	*Fittings.*
Gas	67½%	50%
Water	63½%	45%
Steam	60%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.
Standard Copper (cash).

		£	s.	d.		
Aug.	16	62	9	9	inc.	1/3
,,	17	62	7	6	dec.	1/3
,,	20	62	8	9	inc.	1/3
,,	21	62	7	6	dec.	1/3
,,	22	62	7	6	No change	

Electrolytic Copper.

		£	s.	d.		
Aug.	16	68	15	0	No change	
,,	17	68	15	0	,,	,,
,,	20	68	15	0	,,	,,
,,	21	68	15	0	,,	,,
,,	22	68	15	0	,,	,,

Standard Tin (cash).

		£	s.	d.		
Aug.	16	214	0	0	inc.	10/-
,,	17	215	15	0	,,	35/-
,,	20	212	10	0	dec.	65/-
,,	21	211	17	6	,,	12/6
,,	22	211	10	0	,,	7/6

Tin (English ingots).

		£	s.	d.		
Aug.	16	212	0	0	inc.	10/-
,,	17	213	15	0	,,	35/-
,,	20	210	15	0	dec.	60/-
,,	21	210	0	0	,,	15/-
,,	22	211	0	0	inc.	20/-

Zinc Sheets (English)

		£	s.	d.		
Aug.	16	33	0	0	No change	
,,	17	33	0	0	,,	,,
,,	20	33	0	0	,,	,,
,,	21	33	0	0	,,	,,
,,	22	33	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
Aug.	16	24	13	9	inc.	1/3
,,	17	24	12	6	dec.	1/3
,,	20	24	5	0	,,	7/6
,,	21	24	8	9	inc.	3/9
,,	22	24	6	3	dec.	2/6

Lead (English).

		£	s.	d.		
Aug.	16	23	5	0	inc.	5/-
,,	17	23	5	0	No change	
,,	20	23	5	0	,,	,,
,,	21	23	0	0	dec.	5/-
,,	22	23	5	0	inc.	5/-

Exports of Iron Castings in July and the seven months 1928, compared with July and the seven months 1927.

	July, 1927.	July, 1928.	Seven months, 1927.	Seven months, 1928.	July, 1927.	July, 1928.	Seven months, 1927.	Seven months, 1928.
BUILDERS' CASTINGS—								
Stoves, Grates, etc., Cisterns, Baths, etc., and cooking and washing boilers:—	Tons.	Tons.	Tons.	Tons.	£	£	£	£
To Argentine Republic	132	179	969	1,048	5,751	7,551	35,853	44,885
,, British South Africa	188	232	1,666	2,137	6,861	8,229	59,899	74,464
,, ,, India	37	82	634	903	1,412	3,135	27,333	39,649
,, Australia	50	48	592	407	2,816	3,324	33,439	28,819
,, New Zealand	91	159	1,289	1,161	5,005	8,963	65,755	58,321
,, Other countries	530	836	4,695	5,478	28,899	37,344	238,682	253,912
Total	1,028	1,536	9,845	11,134	50,744	68,546	460,951	500,050
PIPES AND FITTINGS—CAST—								
To Argentine Republic	550	1,104	6,079	5,482	6,363	9,481	65,746	56,194
,, British South Africa	1,925	319	4,714	2,927	19,479	4,821	64,869	46,881
,, ,, India	774	541	4,160	5,457	15,405	7,841	65,124	69,331
,, Straits Settlements and Malay States	1,623	1,751	8,042	9,394	14,592	15,650	79,487	83,965
,, Ceylon	4	113	791	767	77	1,545	9,547	9,373
,, Australia	719	166	5,601	6,079	8,623	2,285	64,862	66,285
,, Other Countries	7,697	3,547	34,486	33,979	89,564	47,509	459,150	446,709
Total	13,292	7,541	63,873	64,085	154,103	89,132	808,785	778,738
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	278	389	2,740	2,708	12,215	14,531	107,332	101,613
,, Enamelled	44	60	407	460	5,164	7,059	41,052	42,694
CASTINGS, in the rough—								
Iron	66	207	651	956	2,141	5,104	24,217	29,439
Steel	102	58	522	382	4,523	2,486	23,442	18,338

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG

IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
19, ST. VINCENT PLACE, GLASGOW.
ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENNTS.

Notice.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

FOUNDRY FOREMAN wanted, age 30-35, for modern Foundry, about end of September; only those need apply who have had experience with repetition work up to one ton; personal application preferred.—Higgs Motors, Witton, Birmingham.

FOREMAN PATTERN-MAKER, with experience in Malleable and Grey Iron, required; used to estimating and pattern-making costs.—State age, experience, and salary, to Box 794, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

YOUNG Metallurgist (27) desires progressive change; 9 years' experience of cupola control, chemical analysis, physical testing, metallography, etc.; moderate salary.—Box 792, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PATENTS AND TRADE MARKS.

INFORMATION HANDBOOKS, Advice, and Cons. free; King's Patent Agency, Ltd.—B. T. King, C.I.M.E. (Regd. Pat. Agent, G.B., U.S.A., and Can.), 146a, Queen Victoria Street, E.C.4. 40 years' refs. 'Phone: 0682 Central.

PROPERTY.

11 ACRES WORKS SITE, SHEFFIELD.

145,000 Sq. Ft. of SHOPPING, Compact and Convenient.

SIDING CONNECTIONS with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers, or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD., ALBION WORKS, SHEFFIELD.

MACHINERY.

FOUNDRY LADLES.—One 15-ton capacity, adapted for bottom pouring. One 6-ton capacity, with worm tilting gear for lip pouring.

CUPOLA.—One Steel Constructed Cupola, height 21 ft. x 3 ft. 10 in. dia.; dia. of Blast Bell or Collar 5 ft. 10 in. x 2 ft. 6 in. deep; complete with Charging Platform.

CRANE.—One Overhead Hand-operated Crane, 24 ft. 6 in. span, 12-ton capacity.

All for Sale cheap.—For further particulars, prices, etc., write Box 796, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

MACHINERY.—*Continued.*

SAND MIXERS.—New and second-hand. Ask us to quote.—W. Brealey & Company, Limited, Prospect Works, Hawksley Avenue, Sheffield.

No. 2 LUMSDEN Oscillating Grinding Machine, 13-in. dia. cup wheel.

DIAMOND Surface Grinding Machine, with magnetic chuck 2 ft. 8 in. x 10 in.

Vertical Rotary Surface and Ring Grinding Machine, with 12-in. dia. magnetic chuck.

No. 11 BROWN & SHARPE Plain Grinding Machine.

One good second-hand BABCOCK WATER TUBE BOILER of 4,356 ft. of heating surface, reinsurable at a working pressure of 150 lbs. per sq. in., with chain grate stoker, etc.

VERTICAL BOILER, 14 ft. 6 in. high x 5 ft. 1 in., reinsure 70 lbs. pressure.

18,000 ft. of NEW 2-in. dia. Screwed and Socketed Piping, in lengths of about 18/21 ft. to British Standard Specifications and tested to 270 lbs. hydraulic pressure.

Portable "Stothert & Pitt" Petrol-driven Concrete Mixer, about 7-cub. ft. capacity, auto. loading hopper, 5-b.h.p. engine.

5-ton "Coles" Loco. Steam Shunting Crane, having 26-ft. jib, 4-ft. 8½-in. gauge, 80 lbs. W.P.

CATALOGUE (10,000 Lots) ON APPLICATION.

THOS. W. WARD LTD., ALBION WORKS, SHEFFIELD.

SAND MIXERS AND CORE-MAKING MACHINES.—Ask for our quotation for new Machines; prices from £14 upwards. Write for List.

SULRON, LIMITED,
FOUNDRY ENGINEERS,
CLOISTER WORKS,
CONGRESS STREET, SHEFFIELD.

MISCELLANEOUS.

PURIC CUPOLA FLUX.—Now used by over 500 Foundries. Ask for special Puric Mailing Card, giving particulars. Send to-day for trial cwt. at 35s. per cwt., carriage paid.

BEECROFT & PARTNERS, LIMITED,
RETORT WORKS,
MAPPIN STREET, SHEFFIELD.

W.O. "PEERLESS" SPECIALITIES.—Fluxes for Brass, Gunmetal and Aluminium; Metallic Cement; Parting Powder; Liquid Core Sand Binder; all best and cheapest.

WILLIAM OLSEN, LIMITED,
COGAN STREET, HULL.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—Cleghorn & Company, Midland Pattern Works, Spring Gardens, Worcester. 'Phone 264.

ANALYSIS AND TESTING.—Send your samples of Iron, Steel, non-ferrous Alloys, Coke, Coal, Oils, etc., to:—

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